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A REVIEW OF THE AVAILABLE LITERATURE OF THE PHARYNX AND PHARYNGEAL SURGERY FOR 1946.*

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EMBRYOLOGY.

Sixty-six guinea pig embryos ranging in length from 2 mm. to 75 mm. were sectioned serially and the pharyngeal region with related structures was studied.[1]. The pharynx of the guinea pig develops by the usual mammalian plan, having four definite pharyngeal pouches of entoderm, formed in cephalocaudal sequence, making contact with corresponding ectodermal depressions or invaginations. The first pouch is the largest and the fourth the smallest.

Parathyroid tissue develops from the medial portion of the third pharyngeal pouch and its position is on the lateral surface of the cephalic pole of the thyroid gland. The cervical vesicle and ectodermal structure lie in contact with the third pharyngeal pouch and late in development becomes infiltrated with lymphocytes to be transformed into thymic material. In the guinea pig, the primordial thymus is derived mainly from the lateral portion of the third pharyngeal pouch and is entodermal, whereas only the extremity of the cephalic lobule, originating from the cervical vesicle, is of ectodermal origin. The thymocytes are of mesodermal origin. The thymus is

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located just under the skin, platysma and sternomastoid muscles of the cervical region in guinea pigs, and no ventral diverticulum of the third pharyngeal pouch is formed, so that no part of the pouch lies in the thoracic cavity. Accessory nodules of thymic tissue are the result of fragmentation of the original anlage and not the differentiation of potential parathyroid cells into thymic cells as claimed by some authors.

BACTERIOLOGY.

Berens and Cumming[2] made nasal and nasopharyngeal bacteriologic smears and cultures on 228 patients in whom chronic upper respiratory disease was one of the suspected causes of associated ocular disorders. The most important pathogens found were toxigenic streptococci (including pneumococci), toxigenic staphylococci and members of the coliform group. Pathogenicity of the staphylococci and streptococci was determined by in vitro tests.

Toxigenic staphylococci were present in nasal cultures alone in 79 instances, in nasopharyngeal cultures alone in 28 instances and in both nose and nasopharynx in 79 cases. Toxigenic streptococci were present in nasal cultures alone in one instance, in nasopharyngeal cultures alone, in 198 cases, and in both nose and nasopharynx in 25 cases. Coliform bacteria were recovered from nasal cultures alone in 24 cases, nasopharyngeal cultures alone in 25 cases, and both nasal and nasopharyngeal in 16 cases.

Berens and Cumming observed that nasopharyngeal cultures alone would have failed to reveal the presence of pathogens or additional pathogens in the nose in 97 instances and in the nasopharynx in 224 cases. In 242 of the 277 sets of cultures, more pathogens were recovered when both nasal and nasopharyngeal cultures were used than would have been obtained if one site or the other were cultured. In only 35 instances in the entire series was the bacteriologic picture identical in cultures from both sites.

In this study, Berens and Cumming show that cultures from both nose and nasopharynx are more reliable indices of

the presence of possible etiologic pathogens than the bacteriologic study of either region alone; however, the necessity of culturing more than these two sites in order to obtain a still more satisfactory bacteriologic picture of the upper respiratory tract may also be pointed out.

Adams and associates[3] studied pharyngeal smears in proved cases of influenza A infection. The series of cases studied was controlled by similar studies on normal individuals of the same age group. The characteristic early lesion seen clinically was that of severe acute pharyngitis. Smears from the throats of over 300 young adults suffering from the disease in the early stages showed destruction of pharyngeal epithelial tissues in which the most important micropathologic feature was a mononuclear exudate made up of small lymphocytes, histiocytes and plasma cells, often mixed with a few polymorphonuclear forms showing pyknosis. Over 68 per cent of the cases showed the mononuclear exudate, whereas in only 18 per cent of the total specimens was a predominant polymorphonuclear exudate noted. In most of these cases, tonsillitis, otitis media, sinusitis or pneumonia was a complicating factor. The finding of a mononuclear exudate in the pharynx in acute influenza seems consistent with the pathologic changes in certain other virus infections both in man and in other animals.

In an effort to stress the importance of the nasopharynx as a structure of pathologic and clinical significance, Hollender[4] reviewed 140 autopsies done consecutively on adult patients from hospitals for mental disorders. Of the bodies examined, 59, or 48.5 per cent, had some type of pathologic lesion. In 41 cases the pathologic processes were tuberculosis, pharyngeal bursitis and hyperplasia of the nasopharyngeal tonsil or the tubal tonsil. Of the remaining 18 cases, pronounced adhesions of the fossa of Rosenmüller were noted in seven, nasopharyngeal cysts in three, follicular pharyngitis in three, cyanotic induration of the nasopharyngeal mucous membrane in three, hyperkeratosis of the mucous membrane in one, and metastatic carcinoma from a primary rectal lesion in one.

Twenty-four of the 140 cases had pulmonary tuberculosis and of these, 18 showed nasopharyngeal tubercular disease. The process is usually ulcerative and is located on the posterior part of the nasopharyngeal roof and on the upper part of the posterior pharyngeal wall. Less frequently it is seen on the posterior margins of the Eustachian tubal orifices and on the nasopharyngeal surfaces of the uvula and soft palate. Two types of nasopharyngeal tuberculosis should be differentiated; that is, the open or ulcerative type and the closed type, discernible only on microscopy.

Hollender noted that nasopharyngeal lymphoid hyperplasia occurred more frequently in the sixth or seventh decades of life than is commonly supposed. Although 10 cases of pharyngeal bursae were found, histologic examination of several specimens revealed that characteristic symptoms of pharyngeal bursitis may be simulated by an infection or inflammatory process in the median recess. Cysts, of course, may arise from any of the nasopharyngeal structures, including the bursa, and may be due to various causes.

EXAMINATION.

Hollender[5] stresses the fact that the nasopharynx has long been a neglected and unexplored region largely because of inaccessibility of this structure and because the instruments available for diagnostic purposes have not been adequate. He discusses the relative merits of the existing instruments used for nasopharyngeal examination and describes an instrument which he has devised and which he believes is far superior to any other. The new Hollender pharyngoscope is patterned after the Yankauer pharyngoscope, except for elimination of the constricted neck found in the Yankauer scope. Illumination has been provided by placing a small light at the distal end of the instrument. According to Hollender, this instrument permits an excellent view of the nasopharynx.

Hendricks[6] describes a technique for making black and white as well as color photographs, through the nasopharyngoscope, with a 35 mm. camera. It consists of a special rack

to support the camera and nasopharyngoscope above the recumbent patient during photography of the nasopharynx.

DISEASES.

Sixty-nine military patients with acute pharyngeal infections were treated at first daily and later twice a day by insufflation into the throat of approximately 5 gr. (325 mg.) of sulfanilamide powder.[7] Evidence of the drug was detectable as long as three hours after insufflation in cases of acute ulcerative tonsillitis, whereas in acute pharyngitis it was present for only a short time. Control patients were treated by warm saline irrigations in cases of acute tonsillitis or pharyngitis, and hydrogen peroxide gargles and application of sodium perborate in cases of Vincent's ulcerative tonsillitis.

The average length of time required for clinical cure in patients with acute tonsillitis treated by the sulfanilamide insufflation method was 1.8 days shorter than in the control group. In Vincent's ulcerative tonsillitis, clinical cure was obtained 1.7 days sooner in the sulfanilamide insufflated group than in the control group.

Streptococcus hemolyticus (beta) was isolated from the throats of 31 of the 64 patients with acute tonsillitis. The fusiform bacillus and Vincent's spirillum were demonstrated in the throats of 49 of the 51 patients with ulcerative tonsillitis. Examination of the blood in 16 patients revealed no detectable amount of sulfanilamide.

The title of this article is a bit misleading as one would surmise that Popov[8] would describe the clinical appearance of the lesion so as to aid the examiner to make a better diagnosis. Unfortunately, however, there is only a repetition of what is contained in ordinary textbooks relative to differential diagnosis. The clinical symptoms of Vincent's angina are reviewed. Popov states that 10 per cent of 164 cases of tonsil infections were due to the Vincent's organism. Vincent's angina is frequently confused with tonsillitis, diphtheria, syphilis and acute leucemia; the microscopic finding of the

organisms establishes the diagnosis. This article contains little of merit.

Copsey[9] presents a review of the incidence, pathogenesis, pathology, diagnosis and treatment of postdiphtheritic paralysis. He employed the following criteria for diagnosis in his 17 cases: *1.* a history of pharyngeal angina and demonstration of virulent diphtheritic organisms, or *2.* a history of pharyngeal angina followed by paresis of the palatal, pharyngeal and ciliary muscles. In cases without paresis of the ciliary muscle, the diagnosis was considered doubtful unless virulent diphtheritic organisms had been or were demonstrable, even though there was a history of pharyngeal angina.

Elevation of the total spinal fluid protein in proportion to the severity of the neurologic involvement, together with the normal spinal fluid cell count was observed in all of Copsey's cases. If respiratory paralysis is avoided in the early stages, recovery may be expected.

Horstmann and associates[10] thought that a series of tests for the presence of poliomyelitis virus in the pharynx compared with its appearance in the stool of the same patients might give information concerning the relative importance of the two sites as sources of recoverable virus. Throat swabs, oropharyngeal washings and stools were collected weekly from 20 patients, including both paralytic and nonparalytic cases in the age group of five to 16 years. The first specimens were collected between the second and eighth days of the disease. Swabs dipped in 10 per cent solution of horse serum in distilled water were used to culture the pharynx, and 10 per cent solution of horse serum was used as a gargle or nasopharyngeal irrigation to obtain washings for culture from the pharynx. Stools or enema returns were collected on the same day. Specimens were collected for six weeks. The materials were frozen on dry ice and maintained frozen until tested. After proper preparation, the specimens were injected intracerebrally into rhesus monkeys. Histologic examination was carried out on all the animals.

Of the samples collected from the oropharynx during the first week of illness, the reaction was positive in 11 per cent,

whereas of those collected from the stool, it was positive in 70 per cent. During the second week of illness, none of the oropharyngeal specimens gave positive reactions, whereas in 57 per cent of the stools the reaction was positive; therefore, Horstmann and co-workers concluded that the virus is eliminated with greater frequency and for a longer period of time in stools than in material from the oropharynx. Of course, this may be due to the fact that one is comparing a fluid specimen which has remained in contact with the mucosa a short time in the case of oropharyngeal swabs and washings with the stool specimen, consisting of excretory waste which has been in contact with the intestinal mucosa for hours.

This study[11] compares the virus content of blood, oropharyngeal washings and stools in a single group of 75 boys between the ages of 15 and 19 years who had been exposed to poliomyelitis in a small epidemic in which an extraordinarily high attack rate prevailed. Samples of blood, oropharyngeal washings and stools from the 75 contacts were divided into 13 pools of each type of specimen and examined for presence of virus. None was found in the blood, one in the oropharyngeal pool and three of the stools yielded virus. The stool material corresponding to the positive oropharyngeal washing was negative.

Eight cases of erythema multiforme are recorded, one of which is reported in detail and the pathogenesis, clinical aspects, complications and treatment of the disease are reviewed.[12] Oropharyngeal lesions, appearing within the first eight hours, are at first bullous but later break down to leave multiple necrotic ulcers. A temperature ranging from 102° to 106° F. accompanied by malaise is present. The breath is foul and severe dysphagia usually occurs. Twenty-four to 36 hours after the onset the bullous lesions appear on the skin and other mucosal areas of the body. Extension to the larynx may necessitate tracheotomy. Diarrhea accompanies the disease in many instances and observations at autopsy have shown lesions throughout the gastrointestinal tract. Corneal lesions rarely occur, but when present show a tendency to

corneal perforation. After five days the temperature returns to normal and the dermal lesions begin to disappear.

Treatment of the dehydration and toxicity of the patient is important. Intramuscular penicillin in adequate dosage is of value in combatting secondary infection. Strict oral hygiene measures and oral penicillin sprays seem helpful in promoting early healing. Rhinopharyngeal focal infection probably is a prominent etiologic factor in the disease and eradication of such foci may give prophylaxis against recurrent attacks.

Davis[13] calls attention to the accepted dictum that the palatine tonsils do not represent the sole lymphoid tissue in the pharynx liable to focal involvement since the posterior pharyngeal wall lymphoid tissue, the lateral pharyngeal bands, the lingual tonsil, the adenoid and the lymphoid remnants and tonsillar stubs may also act as foci of infection. In conditions due to focal infection all the pharyngeal foci should be removed, but relief is often obtained when only a small amount of infection has been eliminated. The methods preferred by Davis are operation, electrocauterization or electrodissection. It is believed that infected lingual tonsils frequently produce cough and tickling sensation in the throat because of pressure on the epiglottis. Davis noted that the size of masses of lymphoid tissue could be reduced by the oral administration of iodine (hydriodic acid, iodides, lipoiodine tablets). Five cases are cited in which pain was relieved when infected pharyngeal lymphoid tissue was removed by one of the methods mentioned.

Joffe and Well[14] present a brief clinical and necropsy review of six fatal cases of malignant diphtheria. They emphasize the following points: *1.* diphtheria should be considered in every case of membranous pharyngitis, *2.* treatment for diphtheria should be started without waiting for laboratory culture reports if the case is suggestive, *3.* large amounts of antitoxin should be given if malignant diphtheria is suspected, *4.* careful observation for obstruction of the respiratory tract should be made so that laryngoscopic or bronchoscopic aspiration as well as tracheotomy can be done if necessary, and *5.* extended

hospital observation of patients having postdiphtheritic paralysis. The salient features of malignant diphtheria include sudden, severe onset, frequent cervical cellulitis, and considerable swelling of pharyngeal parts. An extensive gray or black and hemorrhagic pharyngeal membrane, sometimes extending into the trachea and bronchi, is found. High temperature of septic type and early circulatory failure are characteristic.

It is believed that the present low incidence of diphtheria has led to a sense of security on the part of physicians. Depreciation in ability to recognize and treat the disease is a result. Since diphtheria reached epidemic proportions on the European continent during the late war, it is possible that carriers in our returning armed forces could bring malignant diphtheria to the United States. An excellent review of the epidemiology, bacteriology, prophylaxis and importance of early antitoxin therapy in diphtheria is included.

Keith and Carpenter[15] made a study of 102 cases of nasopharyngitis showing beta hemolytic streptococci (Lancefield A) on throat culture in which antistreptolysin titre was also done on admission to the hospital and one month later. Another group of 234 cases of acute nasopharyngitis showing no beta hemolytic streptococci on their throat cultures was compared with the former group.

It was concluded that an accurate diagnosis of hemolytic streptococcal nasopharyngitis is somewhat difficult. This is true whether antistreptolysin titre, throat swab or clinical appraisal of signs and symptoms is used as a basis of diagnosis. Keith and Carpenter point out the following specific factors in arriving at a diagnosis: *1.* a positive throat culture for beta hemolytic streptococcus (Lancefield A); *2.* history of sudden onset with headache, sore throat and little or no cough; *3.* exudative pharyngitis associated with cervical lymphadenopathy (it was observed that if exudate was present there was four times the chance that the infection was due to hemolytic streptococcus than if no exudate was present); *4.* a white blood count of 12,000 or over (it was noted

that 70 per cent of the cases of proved hemolytic streptococcus infection had leucocytosis).

The use of throat swabs with culture is an important aid in diagnosis. In nearly all cases of hemolytic streptococcal nasopharyngitis the organism will be recovered from the throat. In this series about two-thirds of the patients with acute upper respiratory illness with hemolytic streptococcus (Lancefield A) in their throats were suffering with an infection from that organism and the other one-third were merely carriers with some other infection causing their symptoms.

Keith and Carpenter advocate widespread use of throat cultures for hemolytic streptococcus not only as an aid to diagnosis but, more important, as an aid to elimination of virulent organisms from disease carriers in the early stages before they can spread the infection to others.

Two hundred fourteen soldiers between the ages of 19 and 35, who had clinically active rheumatic fever, were convalescing or had recovered from it, were studied from a standpoint of abnormal oronasal lymphoid tissue.[16] Two hundred normal soldiers in the same age group were used as controls. Of the patients with active rheumatic fever, 74.8 per cent had abnormal nasopharyngeal lymphoid tissue, whereas this condition was present in 48.8 per cent of the convalescent group. Ross believes that prolonged rheumatic disease and the possibility of recurrent attacks are directly related to the presence of abnormal oronasal lymphoid tissue and that proper removal of this tissue appears to lessen the possibility of recurrence and shorten the course of the disease.

Although laryngopharyngeal miliary tuberculosis (Isambert's disease) is not a clinical rarity, it is not often recognized primarily because it is a little known condition.[17] It has occurred as a local manifestation in the course of pleuropulmonary miliary tuberculosis at Laval Hospital, in Quebec, in about 10 per cent of cases. Unlike miliary tuberculosis, it has an acute onset, attacking first the buccal pharynx and then the larynx. The predominant symptoms are: *1.* pronounced dysphagia from the very beginning, preventing alimentation

and scarcely relieved by any kind of therapy; and *2.* asthenia with weakness rapidly leading to a state of complete cachexia. The condition must be differentiated from silicosis, miliary carcinosis and complications of ordinary bronchopneumonia. The presence of pharyngeal and laryngeal lesions preceding the radiologic and even clinical pulmonary course of the disease will permit one to make a diagnosis, which can soon be confirmed by the characteristic granite appearance. The disease is an acute one with a fatal outcome. Opiates and all other treatment are only palliative but should be employed. Two illustrative cases are reported.

Fabricant[15] reminds us that cigarette smokers are numbered in the millions and, therefore, the harmful effects from its use should be of widespread interest. There is, however, little to be found on this subject in textbooks, and it is generally agreed that among many physicians much unsubstantiated opinion prevails as pseudoscientific beliefs.

There are a number of byproducts formed in the combustion of tobacco, and it has not been definitely established which of these various products of combustion is a major factor in producing possible irritation of the delicate mucous membrane. It is thought that the last third of the cigarette is the part which produces the smoke which is most harmful to the mucous membrane. Evidences of chronic pharyngitis, chronic laryngitis and tracheitis characterized by a train of symptoms are observed either individually or collectively in those smoking tobacco. Such individuals can become free of symptoms by abstaining from the use of tobacco if they so desire. Added irritation to a sensitive mucous membrane will produce unpleasant symptoms.

It has been our opinion gained from observations that diethylene glycol prepared cigarettes are less irritating to the mucosa because they contain less acrolein than those prepared with glycerin; however, regardless of the irritation to the mucous membrane or the vasoconstrictor effects produced, patients as well as physicians will continue to smoke because they derive some actual or imaginary pleasure from the habit.

McGillicuddy[19] emphasizes the importance of hypertrophic nasopharyngeal lymphoid tissue as a reservoir of infection in an epidemic of Group A, Type 17, beta hemolytic streptococcus infection occurring in young men at an Army air field. Two hundred out-patients also had a 17 beta hemolytic streptococcus organism in the throat on culture, and of these patients, large central adenoid pads were observed in 78 per cent, adenoid mass obstructive of the Eustachian tubal orifices in 57 per cent, and definite adenoiditis was noted in 79 per cent. As a control series, 100 medical corpsmen, exposed to the infection but not ill and having negative throat cultures, were examined. Although 44 per cent of this group had large adenoid pads and 30 per cent had an adenoid mass obstructive of the Eustachian tubal orifices, the nasopharyngeal lymphoid tissue was not inflamed and did not appear infected. Therapy during the epidemic consisted of the administration of sulfonamides and penicillin. The importance of careful examination of the nasopharynx by mirror and nasopharyngoscope is emphasized.

Mannheimer[20] deplores the fact that most English textbooks on Roentgen ray diagnosis devote only a few words to pharyngeal palsy and the roentgenologic appearances are not even mentioned. Two cases in which a diagnosis of neoplasm of the esophagus was made but which proved to be cases of pharyngeal palsy are reported. The roentgenographic findings in both cases revealed that the opaque material was held up in the postcricoid region, and there was moderate dilatation of the pharynx. The laryngopharynx was full of barium and showed an atonic, sac-like appearance. Both pyriform sinuses and valleculae were sagging and distended with barium. Some of the opaque material found its way into the larynx and trachea.

The symptomatology and roentgenographic findings are discussed at length and many views are presented in this article showing the opaque media in the hypopharyngeal region. Mannheimer states that any residue of barium in the pyriform fossae or valleculae other than its insignificant traits is one of the characteristic signs of pharyngeal palsy. Other

signs of pharyngeal palsy are discussed and the difficulty in swallowing is ascribed to bulbar involvement.

Cummer[21] reports cases of papular leucoplakia of the palate and reviews the literature on this subject. Papular leucoplakia of the palate differs from the usual buccal form of the disease in that it is characterized by gray, flat-topped papules or red hemispheric papules. Thickening of the epithelium with hyperkeratosis, elongation and thickening of the rete pegs, accompanied by capillary enlargement in the papillary bodies, and moderate inflammatory dermal changes are noted histologically. The disease occurs nearly always in men who smoke pipes. Syphilis apparently has no causal relation and, although malignant changes are possible, they are rarely reported. Abstinence from tobacco is all-important in the treatment. Some authors report benefit from the administration of yeast or yeast with iron and hydrochloric acid.

Faucett, Thomas and Ruddock[22] made a study of 561 cases of throat infection occurring in military personnel. The cases studied were divided into groups including scarlet fever, acute tonsillitis, acute pharyngitis, monilia, Vincent's angina, peritonsillar cellulitis and abscess, and Ludwig's angina. The therapeutic measures used in these cases are discussed. Penicillin ice cream, 25,000 units every three hours, is recommended in cases of acute tonsillitis, pharyngitis, scarlet fever pharyngitis and Vincent's angina because it has a beneficial local effect on the pharyngeal lesion, gives a satisfactory blood level and is convenient to administer, easy to prepare and palatable. In the cases of scarlet fever, an initial dose of 18,000 USPH units of streptococcus antitoxin serum preceded the oral use of penicillin ice cream.

Unless spontaneous drainage of peritonsillar abscess is imminent, massive parenteral doses of penicillin are preferred in the treatment of this condition. Prolongation of therapy to prevent the tendency to relapse is emphasized.

Ludwig's angina is preferably treated in the early stages by parenteral administration of penicillin and intravenous

injection of sulfonamides. Oral use of sulfonamides is advised later in the disease.

A study of comparative blood levels shows that although orally given penicillin (penicillin ice cream) produced therapeutic blood levels for over two hours, the parenteral administration of penicillin gave a much higher level; however, the levels were therapeutically satisfactory in the cases studied by Faucett and associates.

Taylor and co-workers[23] conducted interesting experimental work with penicillin lozenges in order to determine the value of the local use of penicillin in oral and throat infections. Their method of study is well described and thorough. The majority of patients use from eight to 12 lozenges daily. Following tonsillectomy, there was less membrane in the tonsillar fossa of these patients than in those who did not use the medication, and they complained of less pain than control patients. The same results were obtained in patients after dental extraction. Several cases of acute tonsillitis and pharyngitis were treated with penicillin lozenges with no apparent benefit. It is thought that topical penicillin is effective in superficial infection of the throat and that its value diminishes if the organisms have penetrated deeper into the tissues. Bacteriologic findings support the clinical observations. The usual and more particularly the streptococcus viridans count of mouth and throat flora was lowered by the use of penicillin lozenges. The persistence of penicillin in mouth washing was of short duration after the disappearance of the lozenges. The results of this study are in close accord with our clinical observations of the value of penicillin used orally.

DIVERTICULA.

Morley[24] describes two cases of squamous epithelioma developing in long-standing pharyngoesophageal pouches. A series of 21 pharyngeal diverticula treated by the one-stage operation is reported. Sixteen of these healed by first intention, severe fistulas developed in three and took nine or 10 weeks

to heal, a minor fistula healing in two days developed in one, and cervical abscesses without fistula which healed in a few days developed in two. Morley attributed the greater incidence of fistulas during the war to the use of poor surgical clamps and inferior catgut with which the neck of the sac was closed. No case of septic mediastinitis was encountered and clinical results have been gratifying to the patients. The surgical anatomy of pharyngoesophageal diverticulum is reviewed, and the predisposing causes of age and sex, as well as symptoms and differential diagnoses are discussed.

A study of 140 cases of diverticulum of the hypopharynx at the pharyngoesophageal junction is presented.[25] Diverticula were found in four different regions of the posterior and lateral pharyngeal wall: *1.* left posterolateral wall between the inferior constrictor and the cricopharyngeus muscles; *2.* right posterolateral wall between these same muscles; *3.* midline posterior wall beneath the median raphe of the inferior constrictor and above the cricopharyngeus muscle; and *4.* midline posterior wall through or immediately beneath the cricopharyngeus muscle above the esophagus.

In one case there were two diverticula, one of the left posterolateral wall type and the other of the right posterolateral pharyngeal wall type.

Of the 140 patients, 115 had the one-stage operation, whereas 25 had the two-stage operation. Pronounced esophageal obstruction prior to operation was present in 15 cases and complete obstruction in three others. Fourteen patients had in-dwelling stomach tubes and one patient had a preliminary gastrostomy. A single death was reported.

Of the 115 cases in which the one-stage technique was employed, temporary fistulas developed in five cases; three patients had temporary hoarseness; one had permanent paralysis of one vocal cord and five had angulation of the esophagus which required dilatation. Of the two patients with recurrences, one was relieved by dilatation and the other required a second operation.

Of the 25 patients treated by the two-stage operation, temporary fistulas developed in six; three had temporary hoarseness; one had permanent paralysis of one vocal cord; five had angulation of the esophagus which required dilatation and three had recurrences which were relieved by dilatations. The average convalescence in the one-stage operative group was three weeks, whereas in the two-stage operative group it was over five weeks.

The clinical manifestations of pharyngoesophageal diverticulum are discussed. An excellent historical review of the treatment of the condition is also presented and the preoperative considerations are given.

Harrington uses regional nerve block with procaine as an anesthetic. The approach of choice is at the side of the neck on which the diverticulum is situated, and a left cervical incision is used in patients having midline diverticula. The details of the one-stage operation, which Harrington prefers, are given. It is important to separate the fascial planes of the mediastinum as little as possible in doing the one-stage operation to minimize the danger of mediastinitis.

The pathology and clinical aspects of pharyngoesophageal diverticulum are reviewed by Waldapfel.[26] The diverticular tract may be made up of all the layers in the esophageal wall, as the result of traction by adhesions or scars, or it may be composed of mucosa alone herniating through the muscular layer as the result of pressure from within. The latter type is by far the most frequent and almost the only one needing treatment.

The history and roentgenographic studies with contrast media are essential to the diagnosis. Esophagoscopy affords information as to the pathologic condition within the sac and its relations to the esophagus.

The two-stage operation for pharyngoesophageal diverticulum is described in a single case report. It is Waldapfel's opinion that excision of the sac is not essential to elimination of symptoms of diverticula, as dislocation of the sac above

the horizontal line through the original level is sufficient to accomplish symptom-free swallowing. In such cases the second stage, or excision of the sac, is not entirely necessary. It is thought that the two-stage operation is also safer with regard to the danger of mediastinitis. A discussion of the mechanism of formation of pharyngoesophageal diverticulum and the histologic findings is also presented.

Lahey[27] recognizes three stages of pharyngoesophageal diverticula: stage 1, in which no true sac exists, but only a small outpouching from the posterior wall of the pharyngoesophageal junction is present; stage 2, in which a dependent sac, parallel with the esophagus and having a sac body, neck and opening into the esophagus is demonstrable; and stage 3, in which the sac is much larger, entering the superior mediastinum, ascending and descending on swallowing, its neck opening directly above into the pharynx. The esophageal opening is small and diverted laterally in the stage 3 diverticulum.

The symptoms and roentgenographic findings in the three stages are reviewed by Lahey. It is believed that the most opportune time for corrective operations is during the early part of stage 2. General anesthesia is preferred. A two-stage operation is performed. The first stage consists of location, dissection and exteriorization of the diverticular sac in the skin incision. After seven to 12 days, a second stage operation is done for severance of the sac from the esophagus and closure of the wound over a cigarette drain. An in-dwelling Levine tube is allowed to remain in the esophagus and stomach for feeding purposes for about seven days.

The results of a study of 209 cases of pharyngoesophageal diverticulum in which the two-stage operation was done are reported. In comparison with the one-stage operation, the incidence of recurrence, mortality rate and period of hospitalization are approximately the same. Lahey prefers the two-stage operation because if leakage should occur after removal of the sac and closure of the esophagus, there will be less possibility of mediastinitis, when a period of time is

allowed for "sealing off" the fascial planes of the neck. In the one-stage operation, no such "sealing off" is possible.

INJURIES.

Muller[28] calls attention to the fact that a supposedly minor injury to the pharynx produced by an object like the mouthpiece of a smoking pipe might prove fatal even if there are little or no physical findings. He reports two such cases. One patient, a 75-year-old man, while smoking a pipe, fell, causing the mouthpiece of the pipe to hit the back of his throat. The injured area became edematous, but this later subsided. Infection, which soon developed, spread rapidly and the patient died of sepsis, circulatory failure and pneumonia 13 days after the injury. The other patient was a 63-year-old man, who sustained a similar fall. A pipe mouthpiece 7 cm. long was extracted from a swelling in the left side of the pharynx. Within two minutes the patient died of hemorrhage from the extraction wound.

LYMPHOID TISSUE.

Hendricks and associates[29] review the pathogenesis of aero-otitis and the rationale for the use of radium in its treatment and report their experience with the use of the nasopharyngeal radium applicator during a period of 12 months in cases of recurrent aero-otitis encountered in five air forces. Of 14,345 air forces' personnel examined for aero-otitis, 6,881 were selected for treatment. A total of 14,045 individual treatments was given. No large scale control program was undertaken.

A treatment consisted of exposure of the nasopharynx to irradiation from two applicators, each containing 50 mg. of radium sulphate. The applicators were allowed to remain in the nasopharynx for 6.6 minutes, a dose of approximately 1 gm. 20 seconds. This was later increased to 1 gm. 25 seconds by allowing the applicator to remain 8.5 minutes. The radium-containing chamber was made of Monel metal, having walls 0.3 mm. in thickness, allowing the emitted rays to con-

sist of approximately 30 per cent beta and 70 per cent gamma rays. Nearly all the beta rays are absorbed in the first 3 mm. of tissue, whereas only 6 per cent of the gamma rays are so absorbed. It is important to place the applicator in such a way that the middle of the radium-containing chamber is in contact with the tubal lip or Eustachian orifice. As a rule, a course of three treatments at 25 to 30-day intervals was given. Occasionally, four or five treatments were needed to produce the desired result.

An outstanding observation noted in each of the air forces groups participating was the definite parallel between subjective and objective improvement. The high percentage of subjective and objective improvement. which accompanies the reduction in lymphoid tissue about the tubal orifices is believed to be conclusive proof that removal of this tissue by irradiation eliminated the major cause of aero-otitis. One of the participating groups noted that irradiation therapy was an effective measure in the prophylaxis of aero-otitis. It was observed that minimal amounts of lymphoid tissue about the tubal orifices might seriously impair the ventilating ability of the Eustachian tube and that irradiation was beneficial in such cases.

Study of the patients failing to improve after irradiation treatment alone showed some cases in which the nasopharyngeal lymphoid mass was of a size to make surgical removal followed by radium the procedure of choice. The lymphoid tissue of some patients appeared to be resistant to irradiation in the dosage employed and might have been improved by additional treatment. Emotional instability, nasal allergy, chronic sinusitis and post-turbinal hypertrophy were causes for failure in a few cases. In a small group of men, no adequate explanation for the lack of improvement could be given.

Fowler[30] presents a review of the anatomy and pathology of the Eustachian tube based upon the work of others and the study of the temporal bones removed from 95 dead airmen in the European theater of operations. Nasopharyngeal lymphoid tissue was commonly seen covering the torus

tubarius. It was observed on the salpingopharyngeal and salpingopalatine folds in about one-third of the gross specimens and was abundant posteriorly in about one-half of the specimens. It is believed that the presence of hyperplastic lymphoid tissue tends to make the pharyngeal orifice of the Eustachian tube a narrow slit to which mucus may adhere, causing tubal obstruction. Microscopy was performed on 16 specimens of the temporal bone. In 11, low grade Eustachian salpingitis was noted. Although lymphoid masses rarely occur anywhere in the tube except the pharyngeal orifice, in chronic infections it is seen in the tubal portion and even in the middle ear.

Eighty airmen who were "grounded" by the air forces examiners for recurrent attacks of aero-otitis were treated by radon or radium. Most of these patients had prominent lymphoid tissue about the pharyngeal orifice of the Eustachian tube. Of 66 patients who received two or more treatments, 46, or 69 per cent, returned to full flying duty after treatment. In order to eliminate psychic factors in the experiment, a control series received treatment with placebo applicators identical to the active ones. The early patients in the series were treated with a platinum applicator containing radon, and in later patients a platinum applicator containing radium sulphate was used. The radon applicator contained 75 millicuries of gas on delivery and the radium applicator contained 50 mg. of the radium salt. The Monel metal applicator was thought to be superior to either brass or platinum applicators, especially if lymphoid tissue was peripherally located. Fowler believes that if this gives unsatisfactory results, it may be advisable to use supplementary Roentgen ray therapy to attack the deeper parts of the Eustachian tube. The gamma irradiation from a brass or platinum capsule may be adequate to reduce the lymphocytic infiltration of the submucosal layers there.

Proctor[31] discusses the mode of action of radioactive substances on body tissues, with particular reference to nasopharyngeal lymphoid tissue. He also describes the radium applicator used by him in the treatment of hyperplastic naso-

pharyngeal lymphoid tissue and outlines its use and care. The procedure for proper protection of personnel handling the applicator is given in detail.

Three hundred twenty-three patients were given 981 treatments. One hundred of these showed complete eradication of nasopharyngeal lymphoid tissue. In 144 patients, there was satisfactory regression of such tissue with clearing of the Eustachian tubal orifice. Ten patients remained completely unimproved, but only two of these had more than two treatments.

Following irradiation, 268 patients showed definite improvement in hearing, and in 19, having severe impairment, hearing was restored to normal; 43 patients, usually afflicted with severe recurrent upper respiratory infections, were free from this affliction during the past winter; eight children with bronchial asthma ceased having attacks and two others were improved; 26 patients suffering from chronic otitis media had no further suppuration over several months, and 19 patients with recurrent otitis media have remained well since treatment.

Whereas three treatments of six minutes and 40 seconds to each side of the nasopharynx with a Monel metal applicator containing 50 mg. of radium sulphate at intervals of 25 days were usually given, five patients received seven treatments with irradiation, five patients received six, and 21 patients received five.

Harris and Montgomery[32] state that during two years 144 patients were treated for nasopharyngeal lymphoid hyperplasia by the application of radium to the nasopharynx according to the accepted methods of Crowe and others. No definite percentages are reported, but the results are said to be "gratifying in mildly and moderately deaf children — less so in adults or in extremely deaf children." The article is documented by three case reports with audiograms taken before and after radiation therapy.

Boies[33] presents a review of the history of irradiation of pharyngeal lymphoid tissue with Roentgen ray, radon and

radium, and outlines the histologic effects of irradiation of lymphoid tissue. Emphasis is placed on the ability of irradiation to inhibit mitosis in lymphocytic germinal centers and thus prevent the formation of new lymphocytes. Since this occurs in cells having a short life cycle, few new lymphocytes are formed during irradiation and the lymphoid mass shrinks in size. Comparison of dosages of radon and radium are drawn.

It is believed that the distribution of the hyperplastic lymphoid tissue plays an important rôle in hearing impairment, particularly in children, resulting from the effect of edema in the Eustachian tube. The tendency toward involvement of the ear from infection of the lymphoid tissue is not in direct proportion to the amount of this tissue, but depends upon the distribution and susceptibility of the patient to the infection. Small doses of radon and radium filtered to yield chiefly beta rays seem to be of value in producing resolution of small amounts of hyperplastic lymphoid tissue interfering with normal Eustachian tube function.

Smith[34] comments on the wide distribution of lymphoid tissue in the pharynx, the nasopharynx and even the posterior part of the septum. Complete surgical removal of lymphoid tissue is impossible; however, next to sex cells, this lymphoid tissue is the most sensitive tissue in the body to irradiation. Smith describes the radium applicator, the technique of application and the beneficial results of this method of treatment, but he warns us of the dangers to which the doctor is exposed in administering this form of therapy. From personal observations it is our opinion that the average physicians using radium applicators do not exercise sufficient caution to protect themselves and their personnel from the constant absorption of radiation. Dental films carried in the coat pocket will demonstrate whether or not radiation is being absorbed because of a leakage from the applicator. Suitable protection should be adopted in all cases in which the dental film carrier shows exposure to radiation.

Fisher,[35] in an excellent discussion, gives full credit to Crowe for the development of radium therapy as used in the

nasopharynx for the prevention of deafness. The article is concise, instructive and should be read by all employing this method of therapy. He reports that experiments over a period of 14 years conducted by Crowe on 15,000 cases showed that impaired hearing for high tones was extremely common in children, as well as in adults. It was discovered that after the removal of enlarged adenoids children regained their hearing for high tones. During childhood the lymphoid tissue in the nasopharynx reacts to infection by increasing in size and spreading by hypertrophy to areas of the mucous membrane, normally free of it. Frequently, after surgical removal of tonsils and adenoids, numerous nodules of lymphoid tissue appear on the lateral and posterior walls of the pharynx. This condition is commonly called granular pharyngitis. This recurrence of lymphoid tissue is not due to inadequate or incomplete original operation but is due to the fact that lymphoid tissue is an integral part of the nasopharyngeal and pharyngeal mucosa, and it is surgically impossible to remove all tiny islands of it without removing a full thickness of the mucous membrane. There seems to be a tendency of this lymphoid tissue to recur around the orifice of the Eustachian tube and this is best determined by use of the nasopharyngoscope. The presence of a mass of lymphoid tissue in the region of the Eustachian tube is usually attended by a series of clinical changes resulting in impairment of hearing. Experimental work and experience have determined that this lymphoid tissue is readily affected when exposed to radiation. It has been further discovered that this type of tissue is best treated by the use of a radium applicator passed through the nose and applied accurately to the area desired.

Fisher describes his method of application and urges that all school children be examined by means of the electric nasopharyngoscope to determine the presence of lymphoid tissue. The onset of deafness in these cases is so gradual and insidious that it may not become apparent until it is too late to correct the primary trouble and restore hearing. He estimates that if such a program could be carried out, the number of cases of deafness in adults in the next generation could be reduced fully 50 per cent.

In addition to the usual beneficial effects of irradiation of the nasopharynx in cases of residual nasopharyngeal lymphoid tissue, Gay[36] states that, in 1,365 children so treated by Crowe, he was convinced that those having frequent winter colds and associated asthmatic bronchitis were much benefited by a properly spaced course of radium therapy. In those sensitive to some inhalant allergen, who obtained unsatisfactory results from desensitization due to the secondary infection in residual nasopharyngeal lymphoid tissue, irradiation was of great assistance. Many cases of persistent postnasal discharge with cough were relieved. The importance of performing routine nasopharyngoscopic examinations in patients suffering from respiratory disease is emphasized.

In an excellent article on the discussion of irradiation, Crowe[37] stresses the fact that many of the disorders of hearing of adult life begin in childhood. It behooves us, therefore, to conduct intensive studies on the various types of otitis in children if we are to be successful in the prevention of deafness. In children, the impairment is just beginning, whereas usually in adults it has progressed so far that irreparable damage has been done. The results of Crowe's investigations have changed our conception that all loss of hearing for high tones is due to lesions of the inner ear or auditory nerve. He has been able to prove that in some cases only the middle ear is involved and, therefore, this loss of hearing for high tones can be improved.

With the help of Dr. Curtis Burnam, an applicator was designed for the irradiation of lymphoid tissue in the vicinity of the Eustachian tube. Dr. Burnam has recently written an article on "Factors in Irradiation" which should be read by all contemplating irradiation therapy. Recurrence of adenoids is not always due to incomplete operation, but chiefly to the fact that lymphoid tissue hypertrophies as a result of infection, allergy and other causes poorly understood. In the majority of children this lymphoid tissue regresses spontaneously soon after puberty without permanent atrophy. More important is the need to recognize early the children

who are in need of treatment in order to prevent permanent damage to hearing.

The method and technique of application of radium to the nasopharynx is accurately described. The benefits from this form of therapy are being appreciated more and more. Radium represents the only form of therapy added to otology in many years and the benefits derived will accrue to the glory of Crowe.

Three cases of polypus of antral origin with extension to the natural antral ostium or an accessory ostium to the nose and to the nasopharynx are presented by Myers.[38] In each case a Caldwell-Luc operation followed by removal of the nasopharyngeal extension of the polypus via the transoral route was done.

STENOSIS.

A brief review of the literature, together with the different operations proposed by various authors for stenosis of the nasopharynx is presented by Kazanjian and Holmes.[39] Of the 16 cases in the authors' operative series, nine followed tonsillectomy and adenoidectomy. In two cases, syphilitic nasopharyngeal stenosis had occurred. One case each of tubercular, traumatic, scarletina, and rhinoscleromatic stenosis is reported. In a single case the stenosis was due to infection of undetermined origin.

The diffuse, avascular, dense scarring which does not tolerate operation well usually follows tuberculosis or syphilis and is difficult to correct, but in those patients in whom stenosis follows surgical trauma a better result may be anticipated.

Several methods of repair, including skin grafts, pocket grafts, excision and insertion of obturator, were tried, and it is believed that all may be disappointing unless soft vascular tissues are present, about or near the stenosis. Kazanjian and Holmes believe that a planned flap, utilizing vascular scar tissue covered by mucous membrane, together with a flap from the adjacent cheek, offers the best chances for a satisfactory

result. The criterion of success in cases of nasopharyngeal stenosis treated by this method is judged by the relief the patient has from the troublesome symptoms arising from the nasal blockage prior to the operation and not the anatomic beauty and symmetry of the soft palate following operation.

BENIGN TUMORS.

Viole[40] reports a case of schwannoma of the pharynx and reviews the gross and microscopic pathology and other characteristics of this neoplasm. The case presented is that of a 20-year-old white man, whose chief complaint was increasing irritation of the throat. At the age of eight, when the tonsils had been removed, an "irregularity" of the throat was reported. At the age of 16, a suggestion of Horner's syndrome was noted and the patient was told that he had a "fleshy" tumor in the throat. By the age of 20, a swelling of submucosal type in the left pharynx, extending from the level of the palate down to the hypopharynx was noted. The tumor was hard and movable with the neck muscles. Biopsy revealed a neurofibroma of the schwannoma type. The tumor, measuring 75 x 58 x 40 mm., was removed transorally under a local anesthetic through a vertical incision behind the posterior pillar. The Horner's syndrome improved, although the left eye remained somewhat sensitive to light. There was no recurrence of the tumor.

It is generally accepted that schwannoma, a benign tumor, originates in the cells of Schwann. It is a peripheral nerve growth. This neoplasm should be differentiated from carotid body tumor and from pharyngeal lymphosarcoma. As the clinical diagnosis cannot usually be easily established, biopsy and histologic study must be done. Irradiation is contraindicated as it is ineffective in small doses, whereas large doses may prove dangerous to the surrounding tissues. Complete surgical removal of the neoplasm is the treatment of choice.

The history of odontoma is reviewed and the classification of Thoma, comprising epithelial, mesenchymal and mixed

types, is presented by McClure.[41] A case of odontoma, reportedly the only one on record occurring in the nasopharynx, is described in detail. Odontoma is commonly seen in the region of the mandibular third molar and is said to occur more often in males than females. It is usually associated with unerupted teeth and is an encapsulated calcified tooth structure containing enamel, dentin and cementum. The compound composite type contains numerous teeth and portions of teeth.

McClure's case, a compound composite odontoma, apparently originated from the posterior ramus of the mandible, but had no direct attachment of its capsule to any bony structure. A typical conductive deafness on the affected side was produced by complete obstruction or absence of the Eustachian tube.

Recurrence of the tumor eight years after its apparently complete removal earlier was believed to be due to a small remaining portion of the capsule in the extreme lateral area of the tumor containing tooth remnants. It is believed that the recurrence of growth and formation of a second deciduous tooth definitely classified the tumor as a compound composite odontoma.

Turchik[42] reports a case of schwannoma of the vagus nerve at its point of emergence from the jugular foramen of the skull. The patient had been hoarse for five years previous to examination and presented a large mass in the right tonsillar fossa, an external swelling below the angle of the right jaw, weakness of the right shoulder, nasal speech and increasing difficulty in swallowing. Right recurrent nerve paralysis was evidenced by a fixed right vocal cord in the "cadaveric" position on mirror laryngoscopy.

The tumor, which was well encapsulated, was removed by the transoral route. Microscopy of the mass, measuring 7 x 4.5 x 3 cm., revealed a neurinoma of the schwannoma type. Horner's syndrome developed in the right eye on the third postoperative day and persisted. Paralysis of the right vocal cord, dysphasia and the speech defect also remained. The weakness of the right shoulder disappeared.

It was thought that the growing tumor, in its location at the jugular foramen, first involved vagal fibres leading to the larynx, producing right vocal cord paralysis five years before operation, followed by later involvement of the fibres innervating the muscles of the pharynx and palate which produced dysphasia and the speech disorder. Expansion of the mass caused pressure upon the adjacent spinal accessory nerve causing weakness in the right shoulder. Occurrence of the postoperative Horner's syndrome is attributed to secondary inflammatory reaction involving the sympathetic plexus surrounding the internal carotid artery.

MALIGNANT TUMORS.

Tice[43] presents an exhaustive review of the available literature on nasopharyngeal neoplasm with special reference to lymphoepithelioma. The histology of transitional cell carcinoma, undifferentiated-cell carcinoma and lymphoepithelioma is described. The usual symptoms of the disease, depending upon its site of involvement, are discussed. Early diagnosis and therapeutic attack are emphasized.

Tice prefers roentgenotherapy alone for lesions involving the tonsillar area, but for lesions involving the nasopharynx, he advocates irradiation to the area by a radium-containing gold capsule of 1 mm. wall thickness for a dose of 1,300 to 1,800 mg. hours, as well as heavy doses of Roentgen irradiation to the metastatic cervical nodes.

Twelve cases are presented in detail; six of these patients were still living at the time of this report. The average duration of life for those dead was two and one-half years, whereas in the six living patients it was two years. Five of the six living patients had a primary tonsillar lesion and the other one had a primary nasopharyngeal lesion. Five of the 12 patients were between the ages of 16 and 21 years and the remainder were between the ages of 41 and 81 years. Eight of the patients were females.

Flynn[44] reports a case of extensive malignancy of the nasopharynx in which a diagnosis of squamous cell epithelioma,

Grade IV, had been made three years previously. After the diagnosis had been made, the patient had properly been given extensive Roentgen ray therapy, following which there was considerable improvement. Roentgen ray therapy was repeated, but in spite of this, metastasis occurred in the lung. By extension this organ as well as the sinuses became involved and headaches and nasal blockage developed. Deafness developed, followed by a period of unconsciousness. In this condition the patient reported for examination. The original diagnosis was confirmed and it was noted that the malignancy in the nasopharynx extended to all surrounding tissue, and there was evidence that all 12 cranial nerves were involved. The patient died shortly after admission, and an autopsy showed extensive metastasis.

As a rule, malignancies of the nasopharynx, particularly transitional cell carcinoma, are highly sensitive to irradiation. It is evident that this malignancy was too far advanced for response to Roentgen ray therapy, and it is surprising that this man survived three and one-half years after the original diagnosis was made. It must be surmised that the Roentgen ray had a retarding effect on the growth of the Grade IV carcinoma, which as a rule grows rapidly and invariably destroys the host much quicker than other grades of the same type of malignancy.

Garcia and associates[45] present the results of radiation therapy in 88 proved cases of carcinoma of the larynx and pharynx at Charity Hospital in New Orleans. In 32 cases the lesion was located in the upper pharyngeal region, whereas in 36 cases it was in the hypopharyngeal and in 20 cases in the endolaryngeal region. Histologic study revealed 65 cases of epidermoid carcinoma, 16 cases of anaplastic carcinoma, three cases of adenocarcinoma, three cases of lymphosarcoma and one case of lymphangioendothelioma.

The technique of roentgenotherapy is given in detail and emphasis is placed upon the necessity for the radiologist to insist on a thorough preliminary study of the patient, as well as personally to watch changes in the neoplasm while treatment is being given.

The three-year survival rate was 24 per cent in the 88 cases reported. In 47 cases observed for more than five years, the survival rate was 21 per cent.

Wycis[46] describes a case in which bilateral intracranial section of the glossopharyngeal nerve was performed for the first time in an attempt to relieve pain in the throat radiating to the ears, produced by a malignant nasopharyngeal lesion. Section of both glossopharyngeal nerves resulted in complete relief of pain. The pharynx became anesthetic and the gag reflex was abolished. On section of the nerves immediate hypertension appeared and persisted the four weeks the patient lived. Death came as the result of the sloughing nasopharyngeal mass secreting into the trachea below, with resultant suppurative pneumonitis. An excellent review of the literature on intracranial section of the IXth nerve and its relation to the production of hypertension is presented.

BIBLIOGRAPHY.

1. Klapper, C. E.: The Development of the Pharynx of the Guinea Pig with Special Emphasis on the Morphogenesis of the Thymus. *Am. Jour. Anat.*, 78:139-179, Mar., 1946.

2. Berens, C., and Cumming, E. L.: A Comparative Study of the Bacteriologic Flora of Nasal and Nasopharyngeal Membranes of Patients with Certain Ocular Disorders. *Am. Jour. Ophth.*, 28:1313-1322, Dec., 1945.

3. Adams, J. M.; Pennoyer, M. M., and Whiting, A. M.: Pathologic Study of the Acutely Inflamed Human Pharynx in Influenza A Infection. *Am. Jour. Dis. Child.*, 71:162-170, Feb., 1946.

4. Hollender, A. R.: The Nasopharynx; a Study of 140 Autopsy Specimens. The Laryngoscope, 56:282-304, June, 1946.

5. Hollender, A. R.: A New Pharyngoscope; Facilitating Diagnosis and Treatment of Nasopharyngeal Diseases. *Eye, Ear, Nose and Throat Month.*, 25:352-353, July, 1946.

6. Hendricks, J. E.: Photography Through a Nasopharyngoscope. *Ann. Otol., Rhinol. and Laryngol.*, 54:797-800, Dec., 1945.

7. Goldman, J. L., and Kiesewetter, W. B.: Treatment of Acute Pharyngeal Infections by Insufflation of Sulfanilamide Powder. *Arch. Otolaryngol.*, 43:99-109, Feb., 1946.

8. Popov, N. P.: Vincent's Angina—Some Diagnostic Pitfalls. *Calif. and West. Med.*, 64:83, Feb., 1946.

9. Copsey, H. G.: Postdiphtheritic Paralysis. *Med. Clin. N. Am.*, 30: 445-450, Mar., 1946.

10. Horstmann, D. M.; Melnick, J. L., and Wenner, H. A.: Isolation of Poliomyelitis Virus from Human Extraneural Sources; Comparison of Virus Content of Pharyngeal Swabs, Oropharyngeal Washings and Stools of Patients. *Jour. Clin. Inves.*, 25:270-274, Mar., 1946.

11. MELNICK, J. L.; HORSTMANN, D. M., and WARD, R.: Isolation of Poliomyelitis Virus from Human Extraneural Sources; Comparison of Virus Content of Blood Oropharyngeal Washings and Stools of Contacts. *Jour. Clin. Inves.*, 25:275-277, Mar., 1946.

12. HOWARD, J. C., JR., and WIBLE, L. E.: Oropharyngeal Manifestations of Erythema Multiforme. *Ann. Otol., Rhinol. and Laryngol.*, 55:146-151, Mar., 1946.

13. DAVIS, D.: Focal Infection in the Pharynx. THE LARYNGOSCOPE, 56:180-185, Apr., 1946.

14. JOFFE, H. H., and WELL, A. H.: Diphtheria: A Report of Six Deaths. *Minn. Med.*, 29:335-339, Apr., 1946.

15. KEITH, J. D., and CARPENTER, J.: The Diagnosis of Hemolytic Streptococcal Infection in Acute Nasopharyngitis. *Canad. Jour. Pub. Health*, 37:127-139, Apr., 1946.

16. ROSS, P. J.: The Incidence of Abnormal Oronasal Lymphoid Tissue in Rheumatic Fever Patients. *Med. Clin. N. Am.*, 30:540-544, May, 1946.

17. COTE, G. L.: La Granulie Pharyngo-Laryngee. *l'Union med. du Canad.*, 76:683-685, June, 1946.

18. FABRICANT, N. D.: Smoker's Throat. *Eye, Ear, Nose and Throat Month.*, 25:312-313, June, 1946.

19. MCGILLICUDDY, O. B.: Nasopharynx in an Epidemic of Streptococcic Infection. *Arch. Otolaryngol.*, 44:202-206, Aug., 1946.

20. MANNHEIMER, B.: The X-ray Appearances of Pharyngeal Palsy. *Brit. Jour. Radiol.*, 19:383-387, Sept., 1946.

21. CUMMER, C. L.: Leucoplakia (Leucokeratosis) of the Palate, Papular Form; Its Relation to the Use of Tobacco. *Jour. A. M. A.*, 132:493-498, Nov. 2, 1946.

22. FAUCETT, R. E.; THOMAS, M. P., and RUDDOCK, J. C.: Treatment of Acute Throat Infections, with Special Reference to the Use of Penicillin. *Calif. Med.*, 65:218-224, Nov., 1946.

23. TAYLOR, D.; CULVER, W. E., and NUNGESTER, W. J.: Effect of Penicillin Lozenges on Clinical and Bacteriological Findings of Patients. *Ann. Otol., Rhinol. and Laryngol.*, 55:743-750, Dec., 1946.

24. MORLEY, J.: Pharyngeal Diverticula. *Brit. Jour. Surg.*, 33:101-106, Oct., 1945.

25. HARRINGTON, S. W.: Pulsion Diverticulum of the Hypopharynx at the Pharyngoesophageal Junction; Surgical Treatment in 140 Cases. *Tr. West. Surg. Assn.*, 52:330-350, 1945.

26. WALDAPFEL, R.: Pharyngoesophageal Diverticulum. *Eye, Ear, Nose and Throat Month.*, 24:579-586, Dec., 1945.

27. LAHEY, F. H.: Pharyngoesophageal Diverticulum; Its Management and Complications. *Ann. Surg.*, 124:617-637, Oct., 1946.

28. MULLER, J.: Pharynxverletzungen durch Pfeife-Mundstucke. *Schweiz. med. Wchnschr.*, 78:32-33, Jan. 12, 1946.

29. HENDRICKS, J. E.; LIEBERMAN, A. E., *et al.*: The Use of Radium in the Aerotitis Control Program of the Army Air Forces. *Ann. Otol., Rhinol. and Laryngol.*, 54:650-721, Dec., 1945.

30. FOWLER, E. P., JR.: Irradiation of the Eustachian Tube, Anatomic, Physical and Clinical Study of Treatment for Recurrent Otitis Media Applied to Aero-otitis. *Arch. Otolaryngol.*, 43:1-11, Jan., 1946.

31. PROCTOR, D. F.: Irradiation for the Elimination of Nasopharyngeal Lymphoid Tissue. *Arch. Otolaryngol.*, 43:473-480, May, 1946.

32. HARRIS, H. E., and MONTGOMERY, E. L.: The Treatment of Lymphoid Hyperplasia of the Nasopharynx by Radium. *Cleveland Clin. Quart.*, 13: 117-124, July, 1946.

33. BOIES, L. R.: Irradiation of Nasopharyngeal Lymphoid Tissue; an Evaluation. *Arch. Otolaryngol.*, 44:129-140, Aug., 1946.

34. SMITH, J. W.: The Use of the Nasopharyngeal Radium Applicator. *Jour. Ark., Med. Soc.*, 43:94-96, Sept., 1946.

35. FISHER, G. E.: Irradiation of Nasopharyngeal Lymphoid Tissue in Prevention of Conduction Deafness. *Eye, Ear, Nose and Throat Month.*, 25:441-444, Sept., 1946.

36. GAY, L. N.: The Treatment of Residual Lymphoid Tissue in the Nasopharynx by Radium. *Jour. Allergy*, 17:348-351, Nov., 1946.

37. CROWE, S. J.: Irradiation of the Nasopharynx. *Ann. Otol., Rhinol. and Laryngol.*, 55:779-788, Dec., 1946.

38. MYERS, D.: Obstruction of the Nasopharynx Secondary to Choanal Polyp of Antral Origin. *Arch. Otolaryngol.*, 44:328-333, Sept., 1946.

39. KAZANJIAN, V. H., and HOLMES, E. M.: Stenosis of the Nasopharynx and Its Correction. *Arch. Otolaryngol.*, 44:261-273, Sept., 1946.

40. VIOLE, P.: Schwannoma of the Pharynx. *Ann. Otol., Rhinol. and Laryngol.*, 55:334-341, June, 1946.

41. MCCLURE, G.: Odontoma of the Nasopharynx. *Arch. Otolaryngol.*, 44:51-60, July, 1946.

42. TURCHIK, F.: Case Report: Schwannoma of the Pharynx with Paralysis of the Vocal Cord. *Arch. Otolaryngol.*, 44:568-573, Nov., 1946.

43. TICE, G. M.: Lymphoepithelioma. *Radiol.*, 47:116-127, Aug., 1946.

44. FLYNN, J. E.: Transitional Cell Carcinoma of the Nasopharynx; Report of a Case with Involvement of All 12 Cranial Nerves. *Jour. Iowa Med. Soc.*, 36:9-11, Jan., 1946.

45. GARCIA, M.; SCHLOSSER, J. V., and MARINO, J. B.: Cancer of the Larynx and of the Pharynx; Results of Radiation Therapy at Charity Hospital. *N. Orleans Med. and Surg. Jour.*, 98:483-490, May, 1946.

46. WYCIS, H.: Bilateral Intracranial Section of the Glossopharyngeal Nerve; Report of a Case. *Arch. Neurol. and Psychiat.*, 54:344-347, Nov.-Dec., 1946.

GABRIEL FALLOPIO

One of the 16th Century Founders of Modern Anatomy; Also Distinguished Physician and Surgeon
1523 - 1562

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The name of Fallopio (Fallopius) is famous for its association with what is probably the most widely known of all medical eponyms.

The Fallopian tube, besides being frequently mentioned in medical books and periodicals, and in discussions in medical societies, colleges and hospitals, is a term also very well known to the laiety, in fact so well known it might be truly called a household word; and yet in a proper sense, as an eponymic term it is not a thoroughly justified one.

The generally accepted criterion for the use of an author's name as an eponymic is priority; and upon this basis the Fallopian tubes should properly be called the Herophilian tubes, or the tubes of Herophilus, a great anatomist, living and teaching in Alexandria, Egypt, in the second century B. C., to whom we are indebted for the discovery and first description of these organs.

The ledger, however, so far as Fallopio is concerned, is balanced by the fact that he in turn has been denied an eponym to which, by the same criterion, he is justly entitled.

The ligament universally called Poupart's ligament should, on the basis of priority, be called the Fallopian ligament, because it was discovered and described by him half a century before it came to the notice of the French anatomist, Poupart.

Fallopio, while credited with one which did not belong to him, and cheated of another which did, is nevertheless honored by other eponyms about which no questions exist, and which are sufficient for his enduring fame. These are:

Fallopian canal, or aqueduct (aqueductus Falopii), a small canal in the petrous portion of the temporal bone, which transmits the facial nerve. It extends from the internal auditory meatus to the stylo-mastoid foramen; is of especial interest to otologists and frequently is the cause of grave consideration in mastoid surgery.

Fallopian hiatus (hiatus Fallopii), an opening on the anterior surface of the petrous for the transmission of the petrosal branch of the Vidian nerve.

Fallopian gestation, an abnormal form of gestation taking place within the Fallopian tube; tubal pregnancy.

Fallopian tubes, two tubes, one on each side, extending from the cornua at the upper end of the uterus outward to the ovaries and serving for the conduction of the ova to the uterus; oviducts, uterine tubes.

Fallopio was one of a brilliant group of sixteenth century anatomists who laid the foundation of modern anatomy; he was also one of the foremost practitioners of his time, and was frequently called to distant cities to prescribe for and treat famous personages.

He was an authority especially on botany, mineral springs and on syphilis.

In addition to succeeding Vesalius in the chair of anatomy and surgery at Padua, Fallopio was also elected Professor of Botany, and in this connection was superintendent of the botanical gardens of the city.

He made a thorough study of plant life and was honored by having a genus of plant named for him.

Due to his efforts his colleagues abandoned many medieval habits in the use of remedies for the cure of disease.

There was still prevalent in his time a strong belief in the old theory of "signatures." According to this theory, plants were supposed to give an indication of their healing properties by certain peculiarities of color or form manifest in leaf, flower or roots: tumeric, because of its yellow color, was good for jaundice; the heart-shaped trefoil for cardiac disease; the thistle for stitch in the side, and walnut, because of its skull shape, for cranial injury!

Fallopio endeavored to put therapeutic practice on a more scientific basis. He devoted special attention to the study of syphilis, which was a terrible scourge in his day.

Syphilis seems first to have appeared in severe epidemic form in Europe shortly after the discovery of America, and it was supposed by many to be of new world origin; however, close students of the subject find certain evidence of its existence prior to that date.

A severe outbreak having occurred throughout Italy following the invasion of Naples by the French, it was generally spoken of in Italy as the French Disease; but the French, alleging an earlier origin, called it the Spanish Disease.

Its present name is derived from Syphilus, chief character in a classical poem on the subject by Girolamo Fracastoro, which appeared in 1530.

Fracastoro was a many-sided genius on the order of Leonardo da Vinci. Besides being a poet, he was an authority on physics, geology and astronomy. He holds a deservedly high place in medical history for his work on contagion, foreshadowing the germ theory of disease.

He definitely attributed infection to the presence of minute living organism (seminaria) having the power of multiplication.

Fallopio accepted mercury as a useful remedy, but he was also a champion of the virtue of certain plants, especially guiac.

That Fallopio was an ingenuous and able surgeon is evidenced from the number of new instruments and new methods of operation which are credited to him.

He advised the use of ligatures in the treatment of wounds, and he exploited the value of trephine in cases of fracture of the cranium.

He devised a new method of treating dislocations, and he was one of the first surgeons to realize that preservation of the periosteum is of vital importance for the repair of bone.

He was the author, too, of an excellent treatise on the subject of ulcers and tumors.

It seems almost incredible that Fallopio, living only to the age of thirty-nine and so busy as he apparently was in the practice of medicine and surgery, should have been able to do very much dissection and anatomical research; but this was his chief occupation, and it was in the field of anatomy that he performed wonders.

As must be expected, many of his discoveries concerned the department of gynecology. He made a very thorough study of the female pelvic organ, and he gave the best description up to his time of not only the uterine tubes which bear his name, but also of the ovaries, the round ligament, the vagina and the placenta, which last two names he originated.

He was first to give a description of the bony system of the fetus.

To no one perhaps are his anatomical discoveries of more interest than to the otologist.

He was the first anatomist to thoroughly explore the minute and intricate structure of the middle and inner ear.

He invented the name tympanum for the middle ear cavity and described and named the three ossicles which traverse this space, as also the round and oval windows of its inner wall.

He noted the intimate association of the malleus and tympanic membrane and also described the incudo-malleolar joint.

He made a special study of the petrous portion of the temporal bone, indicating upon its surface for the first time the landmark bearing his name (the hiatus Fallopii) ; but of more importance he traced through the interior of the petrous the course of the canal which transmits the facial nerve (the Fallopian canal).

He is regarded also as the discoverer of the semi-circular canals, the chorda tympani, and of the acoustic, the glossopharyngeal and of the trigeminal nerves.

Excellent as was his anatomy of the ear, Fallopio fell into some errors when he strayed from this subject. Tinnitus he considered to be due to escaping gas, and he regarded ordinary ear discharge as of cerebral origin.

Of interest to the rhinologist is his discovery of the sphenoid sinus.

Among other important anatomical advances we should mention his description of the muscles of the soft palate, and

of his determination of the true attachments of the intercostal muscles, also his descriptions of the cardiac plexus and of the condyles of the humerus and femur and of the tuberosity of the tibia.

He was the discoverer also of the villi and valvulae conniventes of the small intestine and as already stated, he anticipated Poupart in the discovery of the inguinal ligament.

We know very little of the personal life of this so talented man. Descended from a noble family of the same name, he was born at Modena, in the year 1523. This was about the time of the first publication in Italy of a book illustrating human dissection—very crude attempts they were—in a treatise on anatomy by Berengari, and of the first publication in Latin, the language of the schools, of the work of Hippocrates.

It was at this time that rumblings were being heard indicating a breaking away from the iron-clad doctrines of the old masters of medicine.

When he became a medical student at Ferrara, he no doubt heard often of a former student there named Theophrastus Bombastus Hohenheim, of Switzerland, who later, under the name of Paracelsus, created a great furor in the medical world by publicly burning, in the presence of his students, the standard works of Avicenna and Hippocrates.

No doubt, too, much was heard of another former student, a native of Poland, named Koppernick, who studied and practiced medicine, but later, under the name of Copernicus, was stirring men's minds and souls with a revolutionary idea that the earth upon which they lived was not a fixed immobile body, but a planet which, like Mars and Venus, revolved about the sun.

What probably interested him more than anything else, were the stories being told about a young whipper-snapper from Belgium, named Andre Wesal, who dared to defy his teacher at Paris, the well known Doctor Jacobus Sylvius, by openly declaring that the anatomy of Galen, the revered authority of the schools, was all wrong.

Fallopio left Ferrara to continue his medical studies at Pisa, where his anatomical studies excited such high admiration he became a lecturer and ultimately (1548) professor of anatomy at the university of this city.

In the meantime Wesal had come over to Italy from Paris, and at the early age of twenty-four, under the name of Vesalius, had become professor of anatomy at Padua, and was setting the medical world on fire by his public human body dissections and bold defiance of the teachings of Galen.

Vesalius, who at an early age became professor of anatomy at the University of Padua, was known as "the restorer of human anatomy," and occupies a prominent place in the history of medicine, chiefly for two reasons: he was the author of a splendidly illustrated volume on anatomy (De Fabrica Humani Corporis), based on human dissection; and he was the greatest influence of his time in overthrowing the authority of Galen.

There were, however, two contemporary anatomists, both Italian, who deserve much greater credit for anatomical progress than has usually been accorded them, because they have been overshadowed by the great reputation of Vesalius, namely Bartolomeo Eustachio, professor of anatomy in Rome, and Gabriel Fallopio, the successor of Vesalius at Padua.

Eustachio executed a series of anatomical engravings, which many critics pronounce superior to those of Vesalius, but which for some unexplained reason were not published until 150 years after his death.

The other, Fallopio, in his work, did not lay great emphasis on artistic illustration, but he made, as we have seen, many and very important anatomical discoveries. He was not only courageous in attacking the errors of Galen, but was equally courageous as a critic of Vesalius.

Albrecht van Haller, a competent authority, states that Fallopio, in his controversies with Vesalius was generally on the right side.

Puschman, in a review of the period, does not hesitate to say that the discoveries of Fallopio were the more important

of the two and Daremberg, the French medical historian, sums up the situation by saying that Vesalius was only a scientist; Fallopio, a genius.

Vesalius was in continuous controversy with his colleagues, and though he was a very severe critic and abusive of others, he was intolerant of criticism of himself.

It was said that his sensitivity in this regard led him, in a fit of peevishness, to burn his manuscripts and suddenly to give up teaching.

He quit his post at Padua to become a physician at the court of Charles V of Spain. Here he remained for twenty years, completely divorced from his former work and producing practically nothing, until one day, in 1561, there was brought to him a medical volume which changed the current of his thoughts. It was a book entitled "Observationes Anatomicae" and the author was no other than Gabriel Fallopio, who was now occupying the chair he had formerly held as professor of anatomy at Padua.

There were in this work many statements directly challenging those of Vesalius. They had the effect, it was said, of arousing the dormant fire of the author of "De Fabrica" and his determination to enter the arena again in his former role.

This was now possible, for Fallopio, after eleven years of professorship had recently died. Vesalius, about this time was in some trouble at court, supposedly as a result of an autopsy he performed on a nobleman before death was complete. For this or some other reason, he went on a pilgrimage to Jerusalem. During the voyage he received an invitation to resume his old post at Padua which he accepted and was on his way back when a great storm at sea shipwrecked his vessel, causing his death. His body was unrecognizable but a volume on anatomy lying close by led to his identification. This volume was no other than Fallopio's "Observationes Anatomicae."

So died Vesalius, a short time after the death of his successor, who in turn he intended to succeed and so their fates were intertwined even in death.

Vesalius had been professor at Padua for a period of only five years, but these were five years of extraordinarily intensive work. Then followed twenty years of comparative indolence.

CONCLUSION.

Fallopio was professor of anatomy at Padua for eleven years, and these had been eleven years of unremitting productivness.

He had attained great distinction moreover, not only in the field of anatomy, but also in medicine and surgery.

Though not so spectacular as his famous predecessor, Fallopio contributed not a little toward increasing the prestige of Padua as a center of anatomical study, which reached its climax when Harvey became a student there and received valuable help and hints for his revolutionary blood circulation theory from the then professor of anatomy, Fabricio Aquapendente. Aquapendente no doubt received much help and inspiration from Fallopio who was his teacher.

As to the kind of disposition possessed by Fallopio, we have encountered some difference of opinion. Willis, in his "Life of Harvey," says that he harbored a smothered feeling of dislike toward other authorities, past as well as contemporary, which he could not altogether prevent from breaking out at times in expressions of open hostility.

An entirely contrary estimate is that of his biographer, Portal, who says he was "amiable, affable and not presumptuous," that he was modest regarding his own views, and considerate of those of others, and that he had great esteem and respect for Vesalius, notwithstanding their frequent differences in opinion.

Withington, another historian of the period says of Fallopio, "In the beauty of his personal character as well as the amount and excellence of his work, Fallopio stands first of the Italian anatomists."

Politzer, long time professor of otology in Vienna, wrote a paper for the Italian Journal of Otology (Archiv. Ital. di Otol-Torino, 1897 v 434) in which he expressed the very highest opinion of the character as well as the work of Fallopio. He says his greatness in science was accompanied by a rare elevation of character and that according to his contemporaries he far surpassed Vesalius in geniality, that he was, moreover, "a man of modest courtesy and exquisite tact who recognized the merits of his predecessors and of his colleagues and that he was one of the most beloved persons of his time."

The testimony in his favor so outweighs the reverse that we feel quite sure that Fallopio was no exception to the thesis so well maintained by Osler that the great men of medical history, for the most part, have been men of noble character.

A STATISTICAL STUDY OF AUDITORY TESTS IN RELATION TO THE FENESTRATION OPERATION.†

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I.–INTRODUCTION.

In January, 1945, a cooperative program to study tests of hearing in relation to the fenestration operation was begun at Central Institute for the Deaf and the Department of Otolaryngology of Washington University. All candidates for the operation were given an elaborate series of hearing tests at Central Institute in addition to routine audiometry, clinical tests and examination at the Department of Otolaryngology. Following the operation performed by one of us (T. E. W.) each patient returned to Central Institute for repetition of the hearing tests at least once, and usually three times at increasing intervals, during the first year; and by the spring of 1947 the two-year follow-up tests had begun.

The present paper is a statistical study of the various tests of hearing and their interrelationships. It shows that from among the large battery originally employed we can select a small group of tests which yields substantially all of the information provided by the larger group. This study is based on the tests performed up to Oct. 8, 1946, at which time the testing routine was abbreviated and modified on the basis of experience.

We have also examined the effect of two modifications of the surgical technique of the fenestration operation: *1.* reduction in the amount of exenteration of the mastoid bone, and *2.* the use of the cartilage stopple. In a later paper, in which

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the results of the objective tests of hearing are combined with the replies to a questionnaire sent to all of the patients, the success of the fenestration operation, in terms of social adequacy, will be considered.

II.–APPARATUS AND TEST ROUTINE.

The test room and the apparatus employed for the speech tests in this study have been adequately described elsewhere.[1,2] In brief they comprise: *a.* a quiet, sound-treated room in which the subject sits comfortably, *b.* a high-fidelity electro-acoustic system capable of delivering speech to the listener without overload-distortion at sound pressure levels up to 140 db monaurally (through a PDR-10 receiver) or to 115 db in a free field (through a WE 753-B loudspeaker), *c.* metering and monitoring facilities to regulate the sound levels in steps of 2 db with an accuracy of $\pm$ 1 db, *d.* turntable and electrical pick-up suitable for playing the recorded versions of the tests employed, and *e.* operator's microphone and a talk-back system to maintain continual rapport between patient and operator.

Pure-tone audiometry for both air and bone conduction was conducted in another quiet, sound-treated room, using standard commercial audiometers (usually a Maico D5) and the usual routine of testing. Audiometry was carried out independently both at Central Institute for the Deaf and at McMillan Hospital (Washington University). The McMillan Hospital data are not employed in the present study, however, except to the extent that they contributed to the clinical diagnoses of the type of deafness.

The auditory testing at Central Institute required two sessions of three hours each on successive mornings. Appropriate rest periods were allowed to avoid any effects of fatigue. The battery of tests was given before the operation, and as nearly as practical at three-month, six-month, one-year and two-year intervals after the operation. The same set of tests was given to each ear monaurally and also by binaural hearing in the free field.

III.–AUDITORY TESTS EMPLOYED.

In addition to pure-tone audiometry (both air and bone conduction) the following speech tests were employed:

1. The Threshold of Detectability of Speech.

   A standard sample of recorded speech was made progressively louder until the listener just heard the sound of the voice without being able to distinguish any words.

2. The Threshold for Speech: Western Electric 4C audiometer recordings.

   Two-digit numbers are recorded in pairs at levels successively lower by 3 db steps. We took as the "4C threshold" the sound pressure level at which half (or more) of the numbers were last correctly understood.

3. The Threshold for Speech: Psycho-Acoustic Laboratory Test No. 9.

   Spondaic words (two syllables with equal stress, such as "baseball" and "northwest") are recorded in groups of six at levels progressively lower by 4 db steps. The "No. 9 threshold" is the level, calculated by the tabular method described by Hudgins, *et al.*,[3] at which the listener can repeat correctly 50 per cent of the words.

4. The Threshold for Speech: Psycho-Acoustic Laboratory Test No. 12.

   Simple sentences are recorded in groups of four at levels successively lower by steps of 4 db. The "No. 12 threshold" calculated by the tabular method[3] is the sound level at which the listener can repeat correctly half of the sentences.

5. The Threshold for Speech: Psycho-Acoustic Laboratory "PB" word lists.[4,5]

   Recordings were made at the Technisonic Recording Laboratory at Central Institute of eight of the Psycho-Acoustic Laboratory's "phonetically balanced" mono-

syllabic word lists read by a professional radio announcer. These lists are proportionately representative of the phonetic elements of normal spoken English. Each recording was provided, like the recordings of Tests No. 9 and No. 12, with a 1000-cycle calibrating tone so that the level at which the words reached the listener could be adjusted accurately. The test was administered by playing to the listener four fifty-word lists, each at a different level. The levels were usually

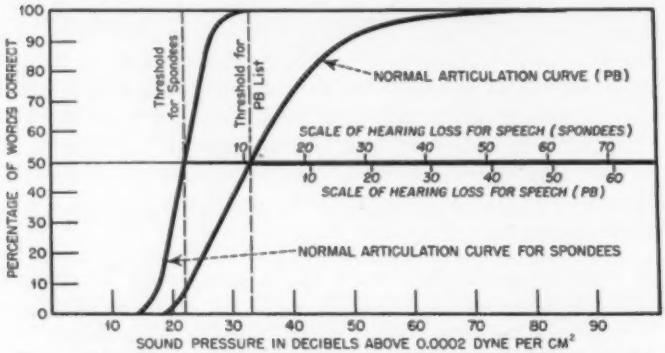

Fig. 1. The normal articulation curve for the monosyllabic words of the PB lists is shown with its threshold (the 50 per cent correct) level at 33 db above 0.0002 dyne/cm². The normal curve for spondees (Test No. 9) is much steeper and lies 11 db lower on the absolute sound pressure scale. The vertical dotted line marking the threshold for the spondees is at 22 db above 0.0002 dyne/cm². It intersects the PB articulation curve at the 8-per-cent-correct level. These relationships are valid for normal listeners tested on the electro-acoustic system at Central Institute for the Deaf and using the recorded forms of the tests mentioned in the text. The PB articulation curve of a hard-of-hearing listener is displaced to the right (hearing loss for speech) in any case, and also downward (loss of discrimination) if he has high-tone nerve deafness. The plateau, i.e., the maximum PB score that a listener ever attains, is normally reached about 30 db above the PB threshold or at about 60 or 65 db sound pressure level. For hard-of-hearing listeners the curve may be displaced so far to the right that the plateau is not reached even at 100 db, and, if there is high-tone nerve deafness, the plateau may be anywhere between 30 and 90 per cent. The level of the plateau is a measure of the patient's power of auditory discrimination.
(From "Hearing and Deafness," Murray Hill Books, Inc., New York, 1947.)

70, 80, 90 and 100 db (re 0.0002 dyne/cm²). The separate "articulation scores" were plotted against intensity. The shape of the normal articulation curve had been determined experimentally for 14 normal ears and is shown in Fig. 1. A template of this shape was cut from a sheet of plexiglas, and by shifting this template

vertically and horizontally the best fit (by eye) was obtained to the experimental points and the patients' "PB articulation curve" was drawn accordingly. The "PB threshold" was taken as the intensity level (in decibels) at which the articulation curve crossed the line representing 50 per cent of words correctly understood.

6. The PB Articulation Score at 100 db.

The percentage of PB words repeated correctly when the sound level of the calibrating tone was 100 db. (re 0.0002 dyne/cm^2) was taken as a measure of the patient's power of auditory discrimination. (It will be shown later that a level of 100 db is not high enough for this assumption to be valid for severely hard-of-hearing ears). It should be noted particularly that all of the preceding tests measure *thresholds* and are expressed in *decibels.* The "PB score at 100 db," on the other hand, is a "*percentage* of words correct" at an arbitrary high level of speech intensity, and is a measure of *discrimination.*

The normal values for the thresholds for speech (Detectability, 4C, No. 9, No. 12, and PB) were determined for groups of 8 to 14 normal ears. The "hearing loss for speech" by each test was calculated by subtracting the normal threshold (in db) from the patients' threshold. The present paper deals with comparisons of the hearing losses for speech measured by these various tests and not with the absolute thresholds. The normal values for the various tests and their interrelationships will be presented elsewhere.

The normal score at 100 db for most of the PB lists is 96 to 100, *i.e.,* given sufficient intensity a listener with normal hearing repeats correctly all or all but one or two of the words in a 50-word PB list. The patients' articulation scores are used directly, and not in the form of an "articulation loss."

IV.—PATIENTS.

One hundred and sixty-one patients, all of whom had the fenestration operation, are included in the study. Forty-

nine were males, 112 were females. Their ages ranged from seven to 63. The mean age for the group at the time of operation was 37.49 years. The standard deviation of ages was 9.83 years. Fifty-four of the patients have had a "revision" operation within two years of the original fenestration, but auditory tests following revision are not considered in the present study.

The patients were classified (by T. E. W.) according to his clinical diagnosis of the type of deafness in the operated ear. The bases of classification were

Clinical and family history,

Air and bone audiograms taken at McMillan Hospital.

Tuning fork tests,

The loudness and quality of the patients' speech,

Otoscopic examination, with emphasis on the appearance of the ear drum,

Mobility of the stapes tested during the fenestration operation.

The results of the auditory tests at Central Institute were not considered in making this classification.

Four categories were set up in advance, although one of them, pure nerve deafness, is not represented in the series on which fenestration was performed. The other three were

1. Pure conductive deafness (C), with no evidence of nerve deafness in the range of frequencies important for speech (250 to 3000 cycles per second): 85 cases;
2. Conductive deafness with mild to moderate nerve involvement (CM): 42 cases;
3. Mixed deafness with predominant nerve involvement (MN): 34 cases.

The cases in the third category were operated upon at the insistent request of the patients themselves and with no hope offered by the surgeon beyond that of a "sporting chance for a slight improvement" of their hearing).

V.—MODIFICATIONS OF SURGICAL PROCEDURE.

The present series includes all of the patients originally operated upon for fenestration by Dr. Walsh at McMillan Hospital up to Oct. 8, 1946. There is, therefore, a possibility of improved results due to improvement of technique as a result of his accumulating surgical experience.

The first 81 operations were performed with extensive exenteration of the mastoid bone. The remaining 79 were performed with the minimum of exenteration of the mastoid consistent with adequate surgical exposure and with correspondingly less distortion of the external auditory canal and adjacent parts.

In 132 operations, a cartilage stopple was placed in the fenestra, according to the description of Lempert[6] with the hope of preventing closure of the fenestra by regrowth of bone. For several months prior to the abandonment of the stopple, increasing efforts were made to make the stopple fit snugly in the fenestra. This effort proved to be misguided. The improvements of hearing were, on the average, less rather than more during this period, and bony closure still occurred. In the present analysis of the results, however, no attempt has been made to separate the tightly fitting from the loosely fitting stopples.

VI.—SELECTION OF TESTS FOR STATISTICAL ANALYSIS.

The number of possible relationships among the results of the various tests is very large. We have, therefore, confined our analysis for the most part to the six following tests: No. 9 (threshold for spondaic words), No. 12 (threshold of sentence intelligibility), PB threshold (monosyllabic words), audiometric hearing loss for speech frequencies (by air conduction and by bone conduction), and the PB score at 100 db.

The analysis was planned to answer such questions as:

1. How reproducible are the results of the various tests? (*i.e.*, what is their reliability?)
2. Does familiarity with the tests improve a patient's performance?

3. To what extent can one test be substituted for another or used to predict the result of another test?
4. How are the test scores related to the clinical groupings?
5. What are the effects of modifications in the operative technique of the fenestration operation?
6. What value do any of the tests have for predicting improvement of hearing by the operation?

In a later paper we will evaluate the success of the fenestration operation in terms of the subjective reports of the patients and in terms of the "social adequacy index" of their hearing before and after operation.

The number of ears (N) used in each statistical calculation is given in each table. The number of ears on which the appropriate tests for answering one or another of the above questions were performed varies considerably. For interrelationships of the speech tests, for example, all tests performed on all ears, whether operated or unoperated, are available. For determining the reliability of the tests only the data obtained on successive tests of the unoperated ear are appropriate. Some data, notably many of the audiometric results, were discarded as technically unsatisfactory when the work of one of our testers proved to be erratic and unreliable.

VII.—RELIABILITY OF SPEECH TESTS.

1. Test-retest Reliability.

If the patient who scored highest in the first test session also scored highest when retested weeks or months later, and those who scored lowest originally also scored lowest on the later test, and there were a similar consistency for those who made intermediate scores, the test would be "reliable." A numerical measure of the reliability is "*r*," the Pearson product moment correlation coefficient.* If the relative order of scores on the retest is the same as on the original test, the value of r is $+ 1.00$. If there is no consistency between test and retest, r tends toward zero. A value of .90 for

*r will be used in this sense throughout this report. Calculation of r is outlined in all standard books on statistics.

r is generally considered to indicate a thoroughly satisfactory reliability.

Table I shows the correlation coefficients for four of the speech tests obtained by comparing the results of the first and second and of the first and third tests on the unoperated ears. The reliability of Test Nos. 9 and 12 is quite satisfactory. For the PB threshold it is still good, and for the PB articulation score at 100 db it is fair. Unfortunately our audiometric data which is technically satisfactory is too scanty for the calculation of similar correlation coefficients.

TABLE I.
TEST-RETEST RELIABILITY COEFFICIENTS AND STANDARD ERRORS OF MEASUREMENT.

	Trials 1 and 2			Trials 1 and 3		
Test	N (No. of cases)	r	α m	N (No. of cases)	r	α m
No. 9	146	.89	3.9 db	60	.86	4.2 db
No. 12	114	.90	4.2 db	35	.79	4.2 db
PB Threshold	146	.79	5.2 db	68	.77	6.0 db
PB Score at 100 db	100	.68	10.5%	44	.68	9.1%

Another index of reliability, *the standard error of measurement* (α m in Table I), is more easily evaluated.[7] This index is an estimate of the standard deviation of the scores which would be obtained if the same subject were tested over and over again. (It is assumed that practice would not improve the subject's performance.) The standard deviation tells how closely bunched the scores are around the mean (average). It tells how accurately the average of the group predicts the result for an individual case. Specifically, it is the range, above and below the true average score, within which lie two-thirds of the individual scores. For example, the standard error of measurement for Test No. 9 is given in column 4 of Table I as 3.9 db. We know, therefore, that for the average subject the chances are two out of three that any single test of his No. 9 threshold is within about 4 db of his true score. This particular value for the standard error of measurement of Test No. 9 is larger than the values found by Falconer and

Davis[8] of 1.95 db for hard-of-hearing subjects and 2.86 db for subjects with normal hearing, but it nevertheless compares favorably with the uncertainty of ± 5 db which is generally accepted as "inherent" in pure tone audiometry.[9]

The standard error of measurement of the PB articulation score at 100 db is rather large. One-third of the actual individual scores deviate by 10 percentage points or more from the subject's true score.

2. Drift or Learning.

The standard error of measurement (α m) estimates the random fluctuations from one test to the next. Another aspect of reliability is the presence or absence of a systematic change or drift in the scores such as might be introduced by a learning or practice factor.

TABLE II.
DRIFT.

Test	DRIFT Trial 1 to Trial 2	Trial 1 to Trial 3
No. 9	+1.5* db	+1.4 db
No. 12	+1.5* db	+3.3* db
PB Threshold	− .8 db	−.8 db
PB Score at 100 db	−4.8*%	−13.2*%

Table II shows the amount of drift that occurred in the four tests in question. (The number of cases is the same as for the corresponding comparisons in Table I.) A positive drift, such as is shown by Tests No. 9 and No. 12, means that on the average the patients' *thresholds* were *lower* on the second test than on the first. A slight learning effect would produce such a drift. The negative drift for the PB articulation score at 100 db means that on the average each patient's *score* was *lower* and lower on successive tests. This unexpected result is the opposite of a learning effect! The stars indicate the changes that are statistically significant at the 1 per cent level; *i.e.*, the probability of an apparent drift of these magnitudes occurring by the operation of chance alone is less than

one in a hundred. The values that are not starred might occur by chance more often than once in twenty, and, therefore, are not considered as statistically significant. The significance was tested both by the conventional "t" tests of significance,[10] and by "sign"* tests. The two tests were in agreement in all cases.

VIII.–INTERRELATIONS OF TESTS.

1. Speech Tests and Audiometry.

The hearing losses by pure-tone audiometry were averaged over the range of frequencies most important for speech; *i.e.*, at 512, 1024, 2048, and 2896 cycles per second. We then compared the average losses with hearing losses for speech (decibel losses) and with articulation scores (percentages of words correct).

The correlation coefficients (r) are shown in Table III.

TABLE III.
CORRELATIONS BETWEEN PURE-TONE AUDIOMETRY AND SPEECH TESTS.

	Air		Bone	
Speech Thresholds	N	r	N	r
No. 9	152	+.74	95	+.45
No. 12	102	+.77		
PB	97	+.72		
PB Score at 100 db			83	–.39

The negative coefficient for the relation of PB score to hearing loss by bone conduction means that with **greater** hearing losses by bone conduction there is some tendency for the articulation score at 100 db to be **lower**,—as we might reasonably expect.

All of them are statistically significant beyond the 1 per cent level. This means that a sample correlation of this size would occur less than once in a hundred times if the true population correlation were zero.[10] The three speech tests do not differ greatly from one another in their correlations with pure-tone hearing losses. As might be expected, the correla-

*The sign test takes account only of the direction of a change, not its magnitude. It has the advantage that its theoretical derivation does not assume that the scores are distributed in a "normal" random distribution. This test is described in a recent government report.[11]

tion of the No. 9 speech test, given by air conduction, is much higher with the pure-tone hearing loss for air conduction than for bone conduction. Even so, the correlation between speech tests and pure-tone audiometry is by no means perfect, as already pointed out by Carhart[12] and others. The results of speech tests cannot be predicted very accurately from pure-tone audiograms, nor can the audiometric loss be predicted accurately from a threshold for speech.

2. Auditory Tests and Clinical Diagnosis.

Two of the tests in Table III might reasonably be expected to correlate with the clinical subdivision of the cases into conductive, conductive-mixed or mixed-nerve deafness. They are: *1.* the bone conduction audiogram and *2.* the PB articulation score at 100 db.

The relation between hearing loss by bone conduction and a diagnosis of nerve (or mixed-nerve) deafness is almost a matter of definition, since bone-conduction audiograms made at McMillan Hospital were one element in the diagnosis. Actually the relationship was confirmed by our data. The average decibel losses by bone conduction (average of losses at 512, 1024, 2048 and 2896 c.p.s.) for the three groups, calculated from the preoperative tests on 95 ears, are as follows:

Conductive ..... 15.2 ± 5.67 db;
Conductive-mixed ..... 25.1 ± 4.97 db;
Mixed-nerve ..... 34.3 ± 6.72 db

The values 5.67, 4.97 and 6.72 are the standard deviations associated with the means listed.

It was anticipated that many patients with significant nerve deafness would show low PB articulation scores even at the 100 db level.[1] With a component of high-tone nerve deafness, their difficulty lies in poor discrimination as well as in an elevated threshold. Actually the average articulation scores at 100 db for the three groups were

Conductive 71.0%
Conductive-mixed 58.1%
Mixed-nerve 45.1%

These figures are calculated from the preoperative tests on 135 ears. The differences are not startling, but they are statistically significant.*

The trends in the above figures may be partly spurious, however, for the following reasons: *1.* Some of the cases of severe hearing loss made low articulation scores because the loudness level, even at 100 db above 0.0002 dyne/cm^2, was too low to put them on the plateaus of their articulation curves (see Fig. 1). We thought originally that 100 db would suffice to reach the maximum articulation score for all fenestration patients, but we have since found that this is not the case owing to the severity of the hearing losses of some of our patients. *2.* The error from this cause (scores too low) is not evenly distributed among the clinical categories. The conductive group is practically free of it because no case of pure conductive deafness can be *very* severe. A hearing loss (air conduction) of more than 50 db implies some nerve deafness, because sounds more than 50 db above normal threshold begin to be heard by bone conduction, even though they be delivered through an air-conduction receiver. This fact was recognized in making the clinical grouping. We do not, therefore, regard the PB scores at the 100 db level as a satisfactory diagnostic test, in spite of the encouraging figures given below.

3. Correlations Among the Speech Tests.

The correlations among four of the tests for the threshold of speech are very high, + .82 or better. Table IV gives the value of *r*, calculated from the initial tests on the number of unoperated ears given in the parentheses.

When these correlations are corrected for the reliability of each test,[7, p. 203] the correlations become practically perfect. For example, the correlation of PB threshold with No. 9 and with No. 12 becomes + .98. In other words, PB threshold, No. 9, No. 12, Detectability, and 4C correlate as well with one another as they do with themselves. Any one of them can be used to predict the results of any of the other three, — so

*The triserial eta (for three-category data) is .43, and is statistically significant beyond the 1 per cent level. The calculation and testing of triserial eta is described in Chapter 11 of Reference 7.

accurately, in fact, that more than one of the tests is superfluous. For example, *it is possible to predict a patient's PB threshold from a measurement of his No. 9 threshold as accurately as we can determine it by a single administration of the PB test itself.* This result was not anticipated. We thought that it might be possible to measure systematic differences between No. 9 and the PB threshold, and that the differences might have a diagnostic significance; but even if this principle is correct the differences are obscured by the imperfect reliability of each of the tests. In practice the choice among the four tests for a threshold of speech will be based on con-

TABLE IV.
CORRELATIONS OF SPEECH TESTS.

	Detectability	Test 4C	Test No. 12	PB Threshold
Test No. 9	(237) .84	(121) .89	(160) .90	(152) .82
Test No. 12				(152) .82

The numbers in parentheses are the number of cases used in each calculation. The decimal fractions are the values of r, the Pearson product-moment coefficient.

siderations of time, the intelligence of the patient, his interest, etc. Mathematically our data show a slight superiority for No. 9 or No. 12 over PB threshold in that their standard error of measurement is less (see Section VII).

It was anticipated that correlation between the PB articulation score at 100 db and the threshold of speech as measured by 4C, No. 9, No. 12 or PB threshold would be low. The expectation was based on the belief that at 100 db nearly all ears would attain their maximum articulation scores. Actually the r value for No. 9 and the PB articulation score at 100 db ($N = 135$) is $-.65$ (see Legend of Table III). This value is quite high considering the low reliability of the PB articulation score itself. It depends largely on the inclusion in the fenestration series of a considerable number of ears with severe hearing loss for speech and very low articulation

scores even at 100 db, the highest level in routine use for this series of cases.

4. Differences in Threshold for the Various Speech Tests.

In 318 tests on unoperated ears the mean threshold for Test No. 12 was 2.8 db above the threshold for Test No. 9. In 312 tests on operated ears the difference was 2.9 db. This difference of about 3 db agrees with Hudgins, *et al.'s*,[3] difference of "three or four decibels" for normal ears.

The mean hearing loss measured by the 4C test for 243 unoperated hard-of-hearing ears was 0.22 db less than the loss measured by Test No. 9. The two tests are almost exactly equivalent except that the absolute value of the 4C threshold is about 4 db above the No. 9 threshold for normal and for hard of hearing alike. The difference is probably due to differences in the conventions of scoring and perhaps also to a difference in the relation of the voice level to the calibrating tone in the recordings of the two tests.

The mean threshold of detectability, at which voice sounds were just consistently identified, lay 5.05 db below the mean threshold for Test No. 9 (N = 237). This difference is less than the 9 db difference in our normal standards, but is still plausible.

The difference between No. 9 and the PB threshold was 11.25 db, as calculated from 152 preoperative tests on the unoperated ears. The PB threshold is higher than the No. 9 threshold because the words are more difficult to discriminate. The difference is the same as for our normal controls (see Fig. 1).

5. PB Equivalents of No. 9 and No. 12 Thresholds.

The No. 9 and the No. 12 thresholds lie well below the PB threshold. The latter, it will be recalled, is the intensity level at which 50 per cent of the PB words are correctly understood. This raises the question of what per cent of PB words are understood, on the average, at the No. 9 and the No. 12 thresholds, *i.e.*, at the intensities at which 50 per cent of the spondaic words or of the sentences are correctly heard.

From our data we can make approximate calculations. (The calculation depends upon the assumption that the PB articulation curve for the hard of hearing has the same shape and slope at its lower end as the normal curve shown in Fig. 1.) The No. 9 threshold corresponds to a PB articulation score of about 3.5 per cent correct. This means that if a patient can understand 50 per cent of the spondaic words at an intensity of say 70 db he can understand only 3.5 per cent of the PB words at the same 70 db level. The No. 12 threshold is 2.9 db above the No. 9 threshold, and the corresponding PB score is 15 per cent correct.

The above calculation is based on finding the average PB score obtained by subjects at the lowest intensity at which they understood 20 per cent or more of the words. [Scores below 20 were disregarded, since we feared that many of the subjects became discouraged and ceased to make a serious effort to understand all of the words when they realized they were missing (or felt that they were guessing at) nearly all of them.] The difference between the No. 9 threshold and the intensity at which each subject made his lowest PB score was calculated, and also the average low PB score for the group. The point representing the average intensity and the corresponding average PB score was located on a chart like that in Fig. 1 and an articulation curve of normal shape was drawn through the point. The score corresponding to the No. 9 threshold was then read off the curve.

In another series of tests (unpublished) on normal subjects we found, by a slightly different method, PB scores of 8 per cent and 23 per cent corresponding to the No. 9 and the No. 12 thresholds respectively. The agreement with the hard-of-hearing values is quite satisfactory as the latter values are only tentative. Final determination of the "PB equivalent score" must be made by actually administering to each of a series of subjects a PB test at his own No. 9 or No. 12 threshold.

IX.–EFFECTS OF FENESTRATION.

1. Gains for Speech, Pure-Tones, and Articulation Scores.

In Table V are given the mean *gains for speech and for pure tones* that were produced by the fenestration operation, measured during the first eight months after the operation. All cases for which satisfactory tests before and after opera-

tion are available are included, without separation according to modification of surgical procedure or according to clinical classification. No distinction is made between tests two months, six months or eight months after operation. The latest test within eight months after operation is the one chosen. (The question of closure of the fenestra will be dealt with elsewhere. Here it is irrelevant, as our interest is in differences between the various auditory tests.)

Table V suggests that the gain for speech is greater than the gain for pure tones. To examine this proposition more carefully, we calculated the difference between the gain for pure tones (512, 1024, 2048 and 2896 c.p.s.) and the gain by

TABLE V.
GAINS IN HEARING FOLLOWING THE FENESTRATION OPERATION.

Test	N	Mean Gain	Confidence Limits
No. 9	144	+13.5 db	13.5 ± 2.3
No. 12	109	+16.2 db	16.2 ± 2.8
PB Threshold	135	+12.1 db	12.1 ± 2.4
Air Audiogram	41	+ 8.9 db	8.9 ± 3.8

The values for the air audiogram are based on averages of the gains for the frequencies important for speech, i.e., 512, 1024, 2048 and 2896 c.p.s. The confidence limits give the limits between which we can expect the true mean to lie 95 per cent of the time (7, page 137).

three of the speech tests for each of the 41 patients on whom we had satisfactory audiograms before and after operation. The mean differences are tabulated in Table VI.

TABLE VI.
EXTRA GAIN FOR SPEECH FOLLOWING FENESTRATION.

Speech Test	Mean Difference, i.e., gain for speech minus gain for pure tones in speech band
No. 9	+4.06 db
No. 12	+5.50
PB Threshold	+1.30

The "t" tests and sign tests of the significance of these differences were carried out. The difference for the PB threshold is not significant, but for No. 12 both tests show that this difference could have been obtained by chance less than once in a hundred times (significance beyond the 1 per cent level). We conclude that *there is a greater gain for speech (measured by Test No. 12) than for pure tones (average of 512, 1024, 2048 and 2896 c.p.s.).* The difference in favor of No. 9 is significant at the 5 per cent level by the "sign" test and beyond the 1 per cent level by the "t" test.

No. 9 and No. 12 are our two most reliable measures of gain for speech. The differences shown in Table VI indicate quite clearly that the average of gains for pure tones over the speech range is not an adequate measure of gain for speech. *Our pure-tone audiograms underestimated by 4 or 5 db the gain for speech that was produced by the fenestration operation.*

The mean change in the *bone conduction audiogram*, measured within eight months after the operation, was –.45 db. Both the "t" test and the sign test show that this small change is not significant. This result is quite in accord with our obvious theoretical expectation.

We also expected that there would be no significant increase in the PB articulation score obtained at the 100 db level, on the theory that at this intensity the PB list would be a test of discrimination and not of sensitivity. Actually there was a mean gain of 5.23 per cent, and the "t" test shows that this gain could have been obtained by chance less than 2 per cent of the time.* Evidently the series included a number of cases with severe hearing loss who were limited by inadequate loudness, even at 100 db, in their ability to understand PB words. Apparently 100 db is not a high enough intensity to bring the PB articulation score up to its maximum value in all patients who are candidates for the fenestration operation.

*In making this calculation all cases that showed a loss of hearing of more than three times the standard error of measurement were eliminated. These four are cases in which the operation, through some surgical accident, abolished completely the hearing in that ear.

2. Relation of Gains to Surgical Technique.

A. Increasing Experience. In order to test for the effect of a gradual general improvement of surgical technique (or a progressively better selection of cases for operation) we calculated the correlation of gains for speech with the serial order of the patients operated. The coefficients (r) were as follows:

Test No. 9	(N = 144)	+.00
Test No. 12	(N = 109)	+.09
PB Threshold	(N = 135)	+.01

None of these coefficients is statistically significant, and there is therefore no evidence of a general drift toward better (or worse) results.

B. Reduced Exenteration. About midway through the series an abrupt change was made in the degree of exenteration of the mastoid bone. The first 82 cases were fully exenterated. The remainder were exenterated only enough to provide convenient working space for making the new fenestra. The corresponding mean gains for speech (measured within eight months) and the calculated values of "biserial eta" are given in Table VII.

TABLE VII.

Test	N	Mean Gain for Speech: Full Exenteration	Mean Gain for Speech: Less Exenteration	Eta
No. 9	143	12.8 db	14.3 db	.06
No. 12	108	14.8	19.4	.14
PB Threshold	134	11.9	12.3	.01

The biserial eta is a measure of the relationship present. The values of eta were tested, but none of them is significant. There is, therefore, no evidence that the degree of exenteration has any significant effect, one way or another, on the gain for speech following the operation.

C. The Cartilage Stopple. Mean gains for speech (measured within eight months) and the corresponding biserial etas

were similarly calculated for the 132 operations in which a cartilage stopple was placed in the fenestra as compared with 29 operations in which no stopple was used.

TABLE VIII.
EFFECT OF CARTILAGE STOPPLE ON GAIN FOR SPEECH

Test	N	Mean Gain for Speech		Eta
		Stopple	No Stopple	
No. 9	143	11.8 db	20.5 db	.24*
No. 12	108	15.3	19.3	.11
PB Threshold	134	10.1	20.8	.30*

The results shown in Table VIII were tested for significance. The probability of the starred values occurring by chance alone is less than one in a hundred. The values are very significant. Tests made at intervals of more than eight months after operation also show an advantage for the operation without the stopple, although the number of cases without stopple tested a year or more after operation is still too small to warrant elaborate statistical calculations. On the basis of these findings, however, the stopple is no longer employed in the fenestration operation at McMillan Hospital.

X.—PREDICTION OF GAIN FOR SPEECH.

Another set of calculations was made to determine whether any of the preoperative tests had any predictive value as to the amount of gain for speech that resulted from the operation. Any such test would, of course, have prognostic value and would aid in the selection of cases suitable for the operation.

1. Loss by Bone Conduction.

We believed that patients with inner ear involvement and consequent loss by bone conduction might benefit less from the operation than patients with normal bone conduction. Actually the correlation between the hearing loss by bone and the gain for speech measured by Test No. 9 is –.19 ($N = 83$).

This relationship is not quite significant at the 5 per cent level, but it does indicate a small tendency in the expected direction. The patients with greater losses by bone gained a little less from the operation than those with lesser losses.

2. Clinical Grouping.

The relationships of the gain for speech to the three clinical groups are shown in Table IX.

TABLE IX.
MEAN GAIN FOR SPEECH FOLLOWING FENESTRATION.

Test	Conductive	Conductive—Mixed	Mixed—Nerve	Eta
No. 9	(77) 14.7 db	(37) 12.6 db	(29) 10.8 db	.1
No. 12	(58) 17.6	(31) 15.7	(20) 13.5	.1
PB Threshold	(79) 12.4	(37) 11.9	(19) 11.2	.03

Numbers in parentheses indicate number of cases in each group.

The last column shows the "triserial eta" which is a measure of the degree of correlation. The values are low, and individually are not significant, but all three tests do show a trend in the expected direction; however, even this uniformity is not statistically significant.

It should not be surprising that the relation of gain for speech from the operation to clinical grouping is slight, because no operations were performed on cases of pure nerve deafness. Cases of pure nerve deafness would theoretically show no improvement. All cases operated had more or less conductive deafness which might be relieved by the operation. The amount of nerve deafness, which some of the patients had to a greater or less degree in addition to their conductive deafness, is the basis of the present grouping. The nerve deafness presumably remained after the operation, but it only slightly reduced the amount of gain for speech that resulted from relief of the *conductive* element in their deafness.

3. The PB Articulation Score at the 100 db Intensity Level.

This test was expected to have much the same predictive value as the loss for pure tones by bone conduction. The actual results are shown in Table X.

TABLE X.
CORRELATION BETWEEN GAIN FOR SPEECH AND THE PREOPERATIVE PB SCORE AT 100 DB.

Speech Test	N	r
No. 9	120	.05
No. 12	90	.00
PB Threshold	122	–.22

Only the last of these coefficients is significant at the 5 per cent level. It is evident that the PB score at 100 db, like hearing loss by bone conduction and the clinical groupings of our patients, has only very slight predictive value for the result of the operation. It may be, however, that in a future series, uncomplicated by the use of cartilage stopple, and using a better measure of auditory discrimination, a clear predictive value for a speech-discrimination test will emerge.

XI.–DISCUSSION.

The points of most immediate interest in this study are: *1.* the poor results following the use of the cartilage stopple in the fenestration operation; *2.* the substantial equivalence of all four of our tests of hearing loss for speech, and *3.* their smaller correlation with pure-tone audiometry; *4.* the greater gain for speech than for pure tones following fenestration, and *5.* the lack of any clear predictive value in any of the tests employed.

In this paper we do not attempt to go beyond our simple statements of the statistical relationships found in our data. Further interpretation, and particularly an evaluation of the success of the fenestration operation in terms of social adequacy and the subjective reports of the patients, are reserved for a future publication. It will there appear, however, that a gain for speech of 20 db, such as shown in Table VIII for the mean gain for cases operated without the stopple, represents a very significant gain from the social and the subjective points of view.

XII.–SUMMARY.

The following tests of hearing were administered to 161 patients before and at intervals after the fenestration operation: *a.* pure-tone audiometry by air and by bone, *b.* threshold of detectability of speech, *c.* threshold of speech for Western Electric 4C recordings and Psycho-Acoustic Laboratory Tests No. 9 and No. 12, and *d.* PB word lists given at several intensities. Both ears of each patient were tested monaurally, and binaural free-field tests were also given.

Statistical analysis of the results of these tests shows that:

1. Test No. 9 (spondaic words) and Test No. 12 (sentences) have a standard error of measurement of about 4 db. The reliability is about the same as for pure-tone audiometry.
2. Hearing losses for speech determined by all of the speech tests listed above correlated so closely with one another (see Table IV) that only one of them need be used in any clinical routine.
3. The prediction of the thresholds for speech from the losses for pure-tones (averaged over the speech range) is less satisfactory than the prediction from one speech test to another.
4. Discrimination for speech measured by the articulation scores obtained on word lists given at high intensity, is better for cases that are predominantly conductive deafness than for cases with a significant amount of nerve deafness.
5. The best results from the fenestration operation, based on tests within eight months postoperative, were obtained in the cases of predominantly conductive deafness, but none of the tests employed showed any great predictive value.
6. The average gain for speech (eight months postoperative) was about 14 decibels. The average gain for pure tones in the speech range was about 9 decibels. Pure-tone audiometry significantly underestimated the gain for speech.

7. No difference in the average *immediate* gain for speech seemed to be associated with any gradual general improvement of surgical technique. Reduction in the degree of exenteration of the mastoid bone also produced no detectable change in the average gain.

8. The use of a cartilage stoppel to prevent bony closure of the fenestra gave on the average about 8 decibels less *immediate* gain for speech, and in many cases did not prevent subsequent closure.

Many details, including correlation coefficients and statistical tests of significance of the conclusions, are given in the body of the paper.

REFERENCES.

1. WALSH, THEO. E., and SILVERMAN, S. R.: Diagnosis and Evaluation of Fenestration. THE LARYNGOSCOPE, 56:536-555, Sept., 1946.

2. SILVERMAN, S. R., and HARRISON, C. E.: Electro-Acoustic Equipment for Clinical Auditory Tests. Report No. PB 43060, U. S. Dept. of Commerce, Washington, D. C., Feb., 1945. See also article in press in *Communications* entitled, "Electro-Acoustic Equipment for Auditory Tests," which is substantially a reprinting of this report.

3. HUDGINS, C. V.; HAWKINS, J. E.; KARLIN, J. E., and STEVENS, S. S.: The Development of Recorded Auditory Tests for Measuring Hearing Loss for Speech. THE LARYNGOSCOPE, 57:57-89, Jan., 1947.

4. EGAN, J.: Articulation Testing Methods. (In preparation.) See also Report No. PBL 22848, U. S. Department of Commerce, Washington, D. C., Nov., 1944.

5. DAVIS, H.: Hearing and Deafness: A Guide for Laymen. New York: Murray Hill Books, Inc., 1947.

6. LEMPERT, J.: Fenestra Nov-Ovalis with Mobile Stopple. *Arch. Otolaryngol.*, 41:1-41, 1945.

7. PETERS, C. C., and VAN VOORHIS, W. R.: Statistical Procedures and Their Mathematical Bases. New York: McGraw-Hill, 1940.

8. FALCONER, G. A., and DAVIS, H.: The Intelligibility of Connected Discourse as a Test for the "Threshold for Speech." THE LARYNGOSCOPE, 57:581-595, Sept., 1947.

9. WITTING, E. G., and HUGHSON, W.: Inherent Accuracy of a Series of Repeated Clinical Audiograms. THE LARYNGOSCOPE, 50:259-269, Mar., 1940.

10. LINDQUIST, E. F.: Statistical Analysis in Educational Research. Boston: Houghton Mifflin, 1940.

11. O.S.R.D. 1945 Publication Board No. 23726: The Statistical Sign Test. Princeton University Statistical Research Groups.

12. CARHART, R.: Speech Reception in Relation to Pattern of Pure Tone Loss. *Jour. Speech Disorders*, 11:97-108, June, 1946.

FOREIGN BODY IN THE EUSTACHIAN TUBE. REPORT OF A CASE.*

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In 1942 Mosher[1] reported three cases of foreign body in the middle ear and mastoid, one of which was slag from welding. He suggested that this industrial hazard was of growing importance and that all such cases should be reported in the literature so that proper attention could be given the subject by the profession. His suggestion has not been followed, for despite the tremendous increase in welding during the war, no new reports are to be found.

Heerman,[2] in 1936, reported 15 cases in blacksmiths and welders and expressed the opinion that the condition must be more common than the literature would suggest. Mosher agreed, having treated 13 cases of slag burn of the tympanic membrane up to 1942.

The following case is of interest because it lends emphasis to many of the points made by Mosher.

REPORT OF CASE.

A 27-year-old merchant seaman came to the Ear, Nose and Throat Clinic for tonsillectomy. He also complained of "sinus trouble." Only on questioning did he mention left ear discharge and deafness, although it was because of this that he wanted his tonsils removed.

His story was that four months previously, in April, 1947, he had been acetylene-welding a pipe in cramped quarters on shipboard. A spark flew in his left ear causing intense pain and sudden deafness. He reported for first aid and the ear was syringed with water. The next day he was referred to a seamen's dispensary and had been followed there ever since. After the first few days a purulent discharge had appeared and had continued, with deafness, to the time of our examination, despite two rather extensive courses of intramuscular penicillin in wax and oil. He was finally told that he must have his tonsils out and the sinuses cleared up before the ear would improve.

There was a past history of repeated tonsillitis, and postnasal discharge with nasal obstruction and headache. Examination showed a fairly typical "allergic" nose, rather large tonsils with some firm cervical nodes, a smooth posterior pharyngeal wall, and mucopus with some slight adenoid

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in the nasopharynx. The right tympanic membrane was quite normal (there had been no previous ear trouble). The left canal was almost full of mucopus. On removal of this, the tympanic membrane was seen to be

Fig. 1A.

slightly retracted with the entire anterior inferior quadrant occupied by a smooth edged perforation. The middle ear mucosa was smooth and red.

A nasal smear was made and sinus films were taken. The roentgenologist* directed attention to the presence of an opaque foreign body in the tympanic part of the left eustachian tube (see Fig. 1).

It seems probable that the bit of slag entered the ear canal and richocheted off the posterior wall to lodge against the tympanic membrane and burn a hole through it. The ill advised douching of the ear could then have forced the

object up into the attic to block the tube and to remain beyond otoscopic vision.

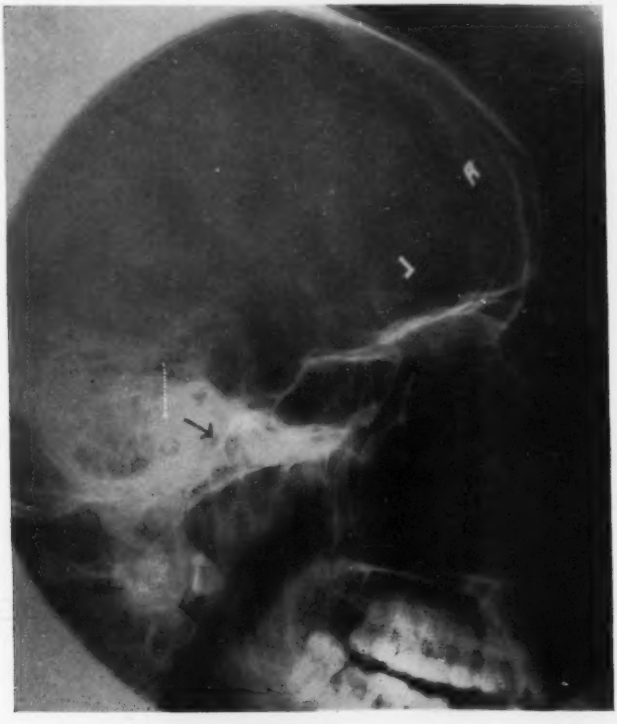

Fig. 1B.

Fig. 1. A and B. Films taken for the sinuses but showing a foreign body in the tympanic portion of the left eustachian tube.

The surprising finding of this foreign body in the tube gave opportunity to apply, in reverse, a technique which had been worked out on the spur of the moment a year or so before in connection with a vexing accident. A woman had had several painful inflations of the tube per catheter for a stubborn catarrhal otitis. She changed otologists after sev-

*Dr. Frank Windholz.

Fig. 2A.

eral weeks and was told that another inflation was necessary for an evaluation of her case, but was assured that it could be done without pain. A small curved tip applicator was used to apply 10 per cent cocaine to the torus. After palpa-

tion of the surrounding areas with the applicator it was left at the mouth of the tube for a minute or two. On withdrawal, it was seen that the cotton had remained behind! Not the slightest wisp of cotton could be seen with the speculum, the mirror, or the nasopharyngoscope, although the patient was not conscious of having swallowed anything. It

Fig. 2B.

Fig. 2. A and B. Useful tip for Politzer bag. The occlusive tip for the Politzer bag that we have used with satisfaction for some time was devised by Dr. Lee Shahinian of our staff. It is simply a rubber tip from a B-D urethral syringe with the edge rounded off. It adapts itself to the postfenestration meatus for the fistula test as well as to the nostril, is comfortable to the patient, cheap, and easily sterilized. Several should be kept on hand.

was reasoned that the shrinking action of the cocaine could have released the vacuum of the middle ear, whereupon the cotton at the tube mouth could have been drawn up a millimeter or two beyond sight. It was certain that the applicator had not been placed far enough into the tube to carry the cotton out of view; however, no shred of it could be recovered by suction applied with a small catheter. Thereupon a myringotomy* was performed and the air in the external canal was compressed with a Politzer bulb. With an audible "plop" the cotton was blown from the tube as with a pea shooter. It was recovered from the floor of the

nose, and, to everyone's satisfaction, there was no recurrence of middle ear fluid.

In the case being reported, the procedure was a follows: a few drops of 10 per cent cocaine and adrenalin 1:1000 (equal parts) were placed in the upturned left ear canal, the patient lying on his side. Intermittent suction was applied to the ear canal with the Politzer bag (Proetz) to allow the solution to enter the middle ear through the perforation. The purpose of this was to reduce mucosal swelling at the upper end of the tube. The head was then turned left side down and a eustachian catheter was placed well into the left torus under observation through a nasopharyngoscope held in the opposite choana. Air pressure was momentarily applied and then the ear was inspected. A spherical bit of slag (slightly magnetic) about 3mm. in diameter lay on the floor of the canal anteriorly. It was easily picked out and within two days all ear discharge ceased.

When last seen, after a month without discharge, the perforation was much smaller. If progress ceases it is planned to roughen the edges and apply a patch. We have closed larger and older perforations by this method and expect that this, too, will close.

The nasal symptoms have responded well to benadryl. (There were clumps of eosinophiles in the nasal smear). The tonsils will be removed and the allergy will be studied.

COMMENT.

Mosher mentions the fact that welding slag most often enters the left ear of right handed individuals. Our case was no exception. He suggested the placing of cotton in the ear as a protective measure. The practice does not seem to have had the support it deserves. He states that discharge ordinarily ceases early, but will continue as long as foreign particles remain in the middle ear. They usually float out with the pus. In questionable cases, he recommends Roentgenograms. In the reported case, our attention was accidentally directed to the foreign body, but in future we will

*(Painless, perhaps because of the diffusion of cocaine as later described by Unger.[3])

certainly have films made when the history suggests the possibility of slag burn. In addition to their value in planning treatment, films may be of medico-legal importance, as pointed out by Wood.[4]

This case also supplies a further argument against the practice of douching an ear without knowledge of the condition of the tympanic membrane. Attention to the history should have made the examiner suspect a perforation by hot slag, and careful examination at the time would probably have revealed it.

Reports of foreign bodies in the eustachian tube are rare. Mangiaracina[5] reports a twisted wire removed by means of an ingenious forceps passed through a eustachian catheter, and Hasting[6] removed the broken tip of a gold bougie via radical mastoidectomy. Steinmann[7] encountered a living worm in the course of a simple mastoidectomy for acute mastoiditis following scarlet fever.

SUMMARY.

A case is reported of otorrhea of four months' duration as a result of a piece of welding slag lodged in the tympanic end of the eustachian tube. It ceased promptly when the foreign body was expelled by catheter inflation of the tube.

The scanty literature is reviewed.

BIBLIOGRAPHY.

1. Mosher, W. F.: Foreign Bodies of External Canal, Middle Ear and Mastoid and Their Complications. *Arch. Otolaryngol.*, 36:679, Nov., 1942.

2. Heerman, J.: Cases of Burns of the Auditory Canal, Middle Ear and Labyrinth Occurring in Welders and Foundry Workers. *Ztschr. f. Hals-, Nasen- u. Ohrenheilk.*, July, 1936.

3. Unger, M.: Cocainizing the Tympanum Via the Eustachian Tube. *Arch. Otolaryngol.*, 45:693, June, 1947.

4. Wood, V. V.: Scissors Point Embedded in Inner Tympanic Wall, with Facial Paralysis. *Ann. Otol., Rhinol. and Laryngol.*, 39:111, Mar., 1930.

5. Mangiarancina, A.: Foreign Bodies in the Eustachian Tube. *Arch. Otolaryngol.*, 32:517, Mar., 1940.

6. Hastings, H.: A Piece of Gold Bougie (20 Years *in Situ*) Removed from Distal Half of Eustachian Tube During a Radical Mastoid Operation. *Ann. Otol., Rhinol. and Laryngol.*, 46:248, Mar., 1937.

7. Steinmann, K. B.: A Worm in the Mastoid. *Monatsschr. f. Ohrenheilk.*, 65:222, 1931.

FENESTRATION OF THE LABYRINTH: A BIBLIOGRAPHY.*

GEORGE KELEMEN, M.D.,

Boston, Mass.

ALDERTON, H. A.: Trephining of the Stapedial Footplate for Otitis Media Sclerosa. *Tr. Am. Otol. Soc.*, 7:60-63, 1898.

ALTMANN, FRANZ: Healing of Fistulas of the human Labyrinth. Histopathologic Studies. *Arch. Otolaryng.*, 43:409-421, Apr., 1946.

AUBONE, J. C.: Ensayos de un nuevo tratamiento quirurgico de la otoesclerosis. *Rev. Argentina de Otorinolaring.*, 13:379, Jan.-Feb., 1944.

AUBRY, A.: La chirurgie de la curdité. *Annales d' otolaryng.*, 13:29-39, Jan.-Feb., 1946.

BABBITT, J. A.: Study of Medical and Surgical Aids to Hearing. *Surg., Gyn. and Obst.*, 68:395-400, Feb., 1939.

BABBITT, JAMES A.: Discussion to Campbell. *Tr. Am. Ac. Opht. and Otolaryng.*, 44:300-301, 1939.

BARANY, ROBERT: Discussion to Jenkins, Otosclerosis: Certain Clinical Features and Experimental Operative Procedures. *Tr. internat. congr. med.*, London, 1913, Sec. 16, Part 2:609-618.

BARANY, ROBERT: Die Indikationen zur Labyrinthoperation. *Acta otolaryng.*, 6:260-288, 1924.

BAST, T. H.: Embryologic Observations Bearing on the Problem of Otosclerosis. *Arch. Otolaryng.*, 36:816-826, Dec., 1942.

BERGGREN, STURE: Ein Versuch operativer Behandlung von einem Fall hochgradiger Otosklerose. *Arch. f. Ohren-, Nasen-u. Kehlkopfheilk.*, 122: 24-30, Aug., 1929.

BERRY, GORDON: The Case of the Hearing Aid. *Tr. Am. Otol. Soc.*, 32:338-358, May, 1929; also: THE LARYNGOSCOPE, 52:615-628, Aug., 1942.

BEYER, HUGO EDWIN HERMANN: Die chirurgische Behandlung der Otosklerose. In: Die Operationen am Ohr., 3rd ed., Leipzig, 1945, Johann Abrosius Barth, pp. 267-276.

BOTEY, RICARDO: The Surgical Treatment of Otic Sclerosis. *Annals of Otol., Rhin. and Laryng.*, 9:386-396, Nov., 1900.

BRUNETTI, FEDERICO: Il moderno pensiero otorinolaringologico. *Gior. veneto di scienze med.*, 12:697-709, Dec., 1938.

BRUNNER, HANS: Otosclerosis. THE LARYNGOSCOPE, 53:736-742, Nov., 1943.

BUSTAMANTE GURRIA, A.: Cirugia en la otoesclerosis. *Prensa med. mexicana*, 10:74-75, Aug. 15, 1945.

CAMPBELL, EDWARD H.: Results in the Labyrinth Fistulization Operation for Chronic Progressive Deafness. Report of Cases. *Tr. Am. Acad. Opht. and Otolaryng.*, 44:265-303, 1939.

CAMPBELL, EDWARD H.: Experiences with Fistulization of the Labyrinth in Chronic Progressive Deafness: Report of Cases. *Arch. Otolaryng.*, 30:689-710, Nov., 1939.

*From the Massachusetts Eye and Ear Infirmary as of Dec. 31, 1946. Corrections and additions, up to this date, are solicited.

CAMPBELL, EDWARD H.: Results in the Labyrinth Fistulization Operation for Chronic Progressive Deafness. Report of Cases. *Annals of Otol., Rhinol. and Laryngol.*, 46:447-465, June, 1940.

CAMPBELL, EDWARD H.: Fenestration of the Labyrinth in Chronic Conductive Deafness. An Analysis of Results Obtained. *Southern M. J.*, 34:13-17, Jan., 1941.

CAMPBELL, EDWARD H.: Further Experiences in Fenestration of the Labyrinth in Chronic Progressive Deafness: Report of Cases and an Analysis of Results. *Aannals Otol., Rhinol. and Laryng.*, 50:182-205, Mar., 1941.

CAMPBELL, EDWARD H.: The Evaluation of the Labyrinth Fenestration Operation for Chronic Progressive Deafness. THE LARYNGOSCOPE, 51: 1009-1052, Nov., 1941. Also: *Arch. Otolaryng.*, 35:149-154, Jan., 1942.

CAMPBELL, EDWARD H.: Fenestration of the Labyrinth: A Report and Analysis of Operated Cases. *Tr. Am. Otol. Soc.*, 32:305-337, 1942. Also: THE LARYNGOSCOPE, 52:593-614, Aug., 1942.

CAMPBELL, EDWARD H.: Fenestration of the Labyrinth: A Report and an Analysis of Cases in Which the Operation Was Performed. *Arch. Otolaryng.*, 37:293-297, Feb., 1943. Disc.: Canfield, Wishart, Morehead, Guild, Maybaum, Jack.

CAMPBELL, EDWARD H., and SILCOX, LOUIS E.: Progressive Deafness—An Abstract Summary of the Available Literature Published during 1941. THE LARYNGOSCOPE, 52:380-415, May, 1942.

CANFIELD, NORTON: Labyrinthine Fistulas. Report of Experiments on Vital Response to Various Methods of Producing Defects in Bone. *Arch. Otolaryng.*, 30:50-62, July, 1939.

CANFIELD, NORTON: The Present Trend in the Treatment of Progressive Deafness. *Connecticut J.*, 4:12-15, Jan., 1940.

CANFIELD, NORTON: The Type of Deafness Which Responds to Fistulization of the Otic Capsule. *Annals Otol., Rhinol. and Laryng.*, 49:248-264, Mar., 1940.

CAWTHORNE, TERENCE: Vestibular Injuries. *Proc. Royal Soc. Med.*, 39: 270-273, Mar., 1946.

COLLEDGE, LIONEL: Surgery. In: The Treatment of Chronic Deafness. British Encyclopedia of Medical Practice, Interim Suppl., 50, pp. 8-10, Nov., 1946.

CROWE, S. J.: Editor's Comment on Articles on Surgery of Otosclerosis. Year Book of the Eye, Ear, Nose and Throat. Chicago, The Year Book Publishers, 1938, 358; 1939, 293; 1940, 395.

DAY, KENNETH M.: Evaluation of the Fenestration Operation for Otosclerosis. *Pennsylvania M. J.*, 48:684-686, Apr., 1945.

DAY, KENNETH M.: Hydrops of Labyrinth (Ménière's Disease). Diagnosis—Results of Labyrinth Surgery. *Annals Int. Med.*, 23:41-47, July, 1945. Also: THE LARYNGOSCOPE, 56:33-42, Feb., 1946.

DAY, KENNETH M.: Appraisal of Fenestration Operation. Report of One Hundred Cases. *Arch. Otolaryng.*, 44:547-559, Nov., 1946.

DUEL, ARTHUR: Otosclerosis: Resumé of Literature to July, 1928. New York, P. B. Hoeber, Inc., 1929. Vols. I and II.

DUERTO, J.: Sobre un nuevo tratamiento de las oto-esclerosis. *Clin. y labor.*, 15:222-226, Mar., 1930.

ENGLISH, RICHARD: I Can Hear Again. *The Saturday Evening Post*, June 1, 1946, pp. 18-19, 117-118, 120.

ENGSTROM, HANS: Über das Vorkommen der Otosklerose nebst experi-

mentellen Studien über chirurgische Behandlung der Krankheit. *Acta otolaryng.*, Suppl. to 43:1-153, 1940.

ENGSTROM, HANS, and ORELL, S.: Regeneration in Bone Defects After Polishing with Metal Burrs. *Acta otolaryng.*, 29:338-347, 1941.

ERSNER, MATTHEW S., and MYERS, DAVID: Surgical Treatment of Deafness: Report of Experiences with the Endaural Labyrinthine Fenestration. *Annals Otol., Rhinol. and Laryng.*, 50:206-234, Mar., 1941.

ERSNER, MATTHEW S., and MYERS, DAVID: Does Heat Created by the Dull Dental Burr During Labyrinthine Fenestration Inhibit Osteogenesis? *Arch. Otolaryng.*, 34:121-124, July, 1941.

FABRICANT, NOAH D.: Surgical Treatment of Otosclerosis. *Am. J. M. Sc.*, 205:604-610, Apr., 1943.

FABRICANT, NOAH D.: Surgical Treatment of Otosclerosis: A Symposium. *Eye, Ear and Throat Monthly*, 24:84-85, Feb., 1945.

FELDSTEIN, E.: Le traitement chirurgical de la surdité par otospongiose. *Rev. gen. de clin. et de therap.*, 46:377-379, June, 1932.

FISHMAN, LOUIS ZOLO: Lempert Fenestration. Preliminary Report on 15 Cases. *Bull. Pract. Opht.*, 16:11-18, July, 1946.

FISHMAN, LOUIS ZOLO, and FISHMAN, VICTOR P.: Tinnitus Aurium, Including Report of Results Following Lempert Fenestration and Tympanosympathectomy. *Bull. Pract. Opht.*, 16:44-57, Dec., 1946.

FISHMAN, VICTOR P.: Plastic Repair of Cartilaginous Nasal Defects. A New Donor Site. *Bull. Pract. Opht.*, 16:61, Dec., 1946.

FISHMAN, VICTOR P.: s. Fishman and Fishman.

FLAGG, PALUEL, J.: The Fenestration Operation. Major Hazard—The Anesthetic. Editorial. *Am. J. Surg.*, 72:497-499, Oct., 1946.

FLEISCHMANN, LADISLAUS: Beiträge zur chirurgischen Behandlung der Otosklerose. *Acta otolaryng.*, 30:139-149, 1942.

FLODERUS, BJORN: Bidrag till stigbygelankylosens operative radikalbehandlung. *Nord. med. ark.*, N.F., 10:1-17, 1899.

FOWLER, EDMUND PRINCE: Otosclerosis; Index of Literature with Abstracts and Index of Authors According to Subjects for 1943. *Arch. Otolaryng.*, 43:143-150, Feb., 1946.

FOWLER, EDMUND PRINCE: Operative Treatment. In: A Report of Progress. Twenty Years' Research in Otosclerosis, Progressive Deafness and Correlated Problems. 1926-1946, pp. 28-31. Central Bureau of Research, American Otological Society, 1946.

FOWLER, EDMUND PRINCE, JR.: Critique of Surgical Treatment for Deafness. *Canad. M. A. J.*, 43:546-552, Dec., 1940.

FOWLER, EDMUND PRINCE, JR.: The Closure of Operative Fenestra in the Labyrinth. *Arch. Otolaryng.*, 34:209-224, Aug., 1941. Also: *Tr. Am. Laryng., Rhinol. and Otol. Soc.*, 47:127-141, 1941.

FRANCIS, R.: Contributions from Sydney, Australia. 2. Congr. Internat. d' Otolaryng., Madrid, 1932, p. 172.

FRASER, J. S.: Bilateral Otosclerosis; Radical Mastoid Operation on Worse Hearing Ear; Bony Cap of Lateral Canal Removed and Skin Graft Applied. Hearing Results Seventeen Years Later. *J. Laryng. and Otol.*, 50:700-701, Sept., 1935.

FREMEL, F.: Demonstration eines wegen Otosklerose vor 8 Jahren operierten Patienten. *Monatsschr. f. Ohrenheilk.*, 56:552-553, July, 1922.

GARCIA, LOPEZ C.: s. Rius and Garcia.

GARIBAY FERNANDEZ, A.: s. Bustamante and Garibay.

GERMAN, TIBOR: On Fenestration of the Labyrinth (in Hungarian). *Orvostudomanyi Kozlemenyek*, 1941, pp. 441-447.

GOLDBERG, S. S.: Lempert Operation for Otosclerosis (Reports of Seven Cases). *Tr. Pacific Coast Oto-Opht. Soc.*, 24:55-62, 1939.

GOODYEAR, HENRY M.: Otosclerosis: Postauricular Approach in Operative Treatment. *Arch. Otolaryng.*, 31:451-457, Mar., 1940.

GREENFIELD, SAMUEL D.: An Evaluation of the Lempert Fenestra Nov-Ovalis Operation in the Treatment of Otosclerosis. Report of Thirty-six Patients Who Were Selected for This Operation. *Arch. Otolaryng.*, 43: 25-30, Jan., 1946.

GROVE, WILLIAM E.: The Rôle of the Otologist in a Hearing Conservation Program. *Annals Otol., Rhinol. and Laryng.*, 54:458-465, Sept., 1945.

GUGGENHEIM, LOUIS, and GUGGENHEIM, PAUL: Artificial Fistula in Case of Otosclerosis. *Arch. Otolaryng.*, 32:1-15, July, 1940.

GUGGENHEIM, PAUL, and GUGGENHEIM, LOUIS: A New Method for Inhibiting Osteogenesis in Artificial Bone Fistulas. *Arch. Otolaryng.*, 34:356-357, Aug., 1941.

GUGGENHEIM, PAUL, and GUGGENHEIM, LOUIS: Bone Fistula. Further Studies. *Arch. Otolaryng.*, 38:139-147, Aug., 1943.

HALL, I. SIMSON: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:365-366, June, 1939.

HALL, I. SIMSON: Progressive Middle Ear Deafness. *Edinburgh M. J.*, 49:352-365, May, 1942.

HALL, I. SIMSON: Surgical Treatment of Otosclerosis. *Proc. Royal Soc. Med.*, 37:737-743, Oct., 1944. Also: *J. Laryng. and Otol.*, 59:255-266, July, 1944. Disc.: Cawthorne, Fowler, Passe, Howarth, Hutchinson, Hall.

HALL, I. SIMSON: Fenestration of the Labyrinth. *J. Laryng. and Otol.*, 60:200-215, May, 1945.

HAUTANT, A.: Indications et résultats éloignés du traitement chirurgical des vertiges auriculaires. *Bull. Acad. med.*, Paris, 111:933-939, June 26, 1934.

HILL, FREDERICK T.: The Changing Conception of the Management of Progressive Deafness. *Annals Otol., Rhinol. and Laryng.*, 51:653-661, Sept., 1942.

HOLMGREN, GUNNAR: Om otosclerosen. *Oto-laryngologiska Meddelanden*, 1:483-496, Sept., 1913. Also: *Hygiea* (Stockholm), 75:680-693, 1913.

HOLMGREN, GUNNAR: Ett fall av tidig otoskleros med osäker diagnos samt ett fall av otoskleros, opererat med hörselförbättring. *Oto-laryngologiska Meddelanden*, 1924, 666.

HOLMGREN, GUNNAR: Fall ov otoskleros, förbättrat till hörsel efter anläggande av nytt fönster á promontorium. *Oto-laryngologiska Meddelanden*, 1924, 711.

HOLMGREN, GUNNAR: Operations on the Temporal Bone Carried Out with the Help of the Lens and Microscope. *Acta otolaryng.*, 4:383-393, 1922.

HOLMGREN, GUNNAR: Some Experiences in the Surgery of Otosclerosis. *Acta otolaryng.*, 5:460-466, 1923.

HOLMGREN, GUNNAR: Opérations sur l'os temporal á l' aide de la loupe et du microscope. *Revue de laryng. et otol.*, 44:8-17, 1923.

HOLMGREN, GUNNAR: Demonstration av ett fall operat för otoscleros. *Nordisk Medicin*, 1:320-321, 1923.

HOLMGREN, GUNNAR: On the Indications for Labyrinth Operation Ac-

cording to Experiences Gained at the Sabbatsberg Clinic. *Acta otolaryng.*, 6:237-259, 1924.

HOLMGREN, GUNNAR: Zur Chirurgie der Otosklerose. *Acta otolaryng.*, 15:7-12, 1931.

HOLMGREN, GUNNAR: Zur Chirurgie der Otosklerose. *Acta otolaryng.*, 24:271-283, 1936.

HOLMGREN, GUNNAR: Chirurgia dell'otosclerosi. *Valsalva*, 12:497-507, Nov., 1936.

HOLMGREN, GUNNAR: Surgical Treatment of Otosclerosis. *Nord. med. tidskr.*, 12:1545-1550, Sept. 19, 1936.

HOLMGREN, GUNNAR: Zur Chirurgie der Otosklerose. *Zeitschr. Hals-, Nasen- u. Ohrenheilk.*, 40:440-450, 1937.

HOLMGREN, GUNNAR: The Surgery of Otosclerosis. *Annals Otol., Rhinol. and Laryng.*, 46:3-12, Mar., 1937.

HOLMGREN, GUNNAR: Surgical Therapy of Otosclerosis. In: Kopetzky, S. J.: Surgery of the Ear. New York, Thomas Nelson and Sons, 1938, pp. 398-430.

HOLMGREN, GUNNAR: Ein operierter und an intercurrenter Krankheit gestorbener Fall von Otosklerose. *Acta otolaryng.*, 26:340-342, 1938.

HOLMGREN, GUNNAR: Die Chirurgie der Otosklerose. *Hygiea* (Stockholm), 100:681, Oct. 8, 1938; 757, Oct. 15, 1938.

HOLMGREN, GUNNAR: Der jetzige Standpunkt der Otosclerosechirurgie. *Nordisk Medicin*, 2:1704-1705, 1939.

HOLMGREN, GUNNAR: Zur Chirurgie der Otosklerose. *Acta otolaryng.*, 27:338-349, 1939.

HOLMGREN, GUNNAR: Demonstration of a Case Operated on for Otosclerosis. *Acta otolaryng.*, 28:304-307, 1940.

HOLMGREN, GUNNAR: Die Entwicklung der Oto-Laryngologie in Schweden während der letzten 40 Jahre. Ein Rückblick. *Acta otolaryng.*, 29: 1-13, 1941. Also: Development of Otolaryngology in Sweden During the last 40 Years. *Nord. med. (Hygiea)*, 9:297-301, Jan. 25, 1941.

HOLMGREN, GUNNAR: Otosclerosis: Symptoms in External and Middle Ear. *Acta otolaryng.*, 29:91-97, 1941.

HOLMGREN, GUNNAR: Otosklerose-Chirurgie. *Practica oto-rhino-laryng.*, 8:441-445, 1946.

HOWARTH, WALTER: Surgical Treatment of Otosclerosis. *St. Thomas' Hosp. Rep.*, 2:151-153, 1937.

HOWARTH, WALTER: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:363, June, 1939.

HUGHSON, WALTER: Discussion of Canfield's paper: "The Type of Deafness Which Responds to Fistulization of the Otic Capsule." *Annals Otol., Rhinol. and Laryng.*, 49:262-264, Mar., 1940.

HUGHSON, WALTER, and THOMPSON, EVA: Otological Research and Its Recent Contributions to Clinical Otology. *Annals Otol., Rhinol. and Laryng.*, 50:77-112, Mar., 1941.

HUTCHINSON, C. A.: A Severe Degree of Middle-Ear Deafness Treated with Some Measure of Success by Sourdille's Procedure. *J. Laryng. and Otol.*, 51:465-471, July, 1936.

HUTCHINSON, C. A.: Clinical Record: A Case of Membranous Periotic Deafness Treated Surgically by Sourdille's Procedure. *J. Laryng. and Otol.*, 54:714-723, Dec., 1939.

JENKINS, G. J.: Labyrinthine Vertigo (Ménière's Symptoms — Non-

infective) Treated by Operation. *Proc. Royal Soc. Med.*, 4:116-120, May 19, 1911; 5:80-83, Jan. 19, 1912.

JENKINS, G. J.: Serial Microscopic Sections of the Labyrinth and middle Ear Showing Ankylosis of the Stapes; Otosclerosis. Demonstration of Microscopical Specimens. *Proc. Royal Soc. Med.*, 7:55-56, Apr. 17, 1914.

JENKINS, G. J.: Otosclerosis: Certain Clinical Features and Experimental Operative Procedures. *Tr. Internat. Congr. Med.*, London, 1913, Sect. 16 (Otol.), Part 2:609-618 (Disc.: Bárány).

JENKINS, G. J.: The Treatment of Otosclerosis. *J. Laryng. and Otol.*, 29:520-523, Nov., 1914.

JENT, R.: Die chirurgische Behandlung der Otosclerose. *Practica oto-rhino-laryng.*, 7:275-281, 1945.

JOHNSON, LEIGHTON F., and ZONDERMANN, BERNARD: Experiences with Endaural Surgery. *Arch. Otolaryng.*, 33:1004-1007, June, 1941.

JONES, MARVIN FISHER: Otosclerosis, with Unusual Pathologic Findings. *Arch. Otolaryng.*, 35:165-166, Jan., 1942.

JONES, MARVIN FISHER: Surgical Treatment of Impaired Hearing. The Results Obtained by Using the Lempert Endaural Fenestration Technic. *Tr. Am. Acad. Opht. and Otolaryng.*, 48:284-287, Mar.-Apr., 1944.

JUERS, ARTHUR L.: s. Shambaugh and Juers.

KATZ, BENJAMIN: Limitations of Surgery in Otosclerosis. THE LARYNGOSCOPE, 51:246-255, Mar., 1941.

KEND, LEE: The One-stage Fenestration Operation Using the Postaural Approach. THE LARYNGOSCOPE, 51:37-51, Jan., 1941.

KINNEY, CHARLES E.: A Critical Review of the Fenestration Operation: Report of Cases. THE LARYNGOSCOPE, 55:117-127, Mar., 1945.

KINNEY, CHARLES E.: Some Questions and Answers Concerning the Fenestration Operation. *Ohio State M. J.*, 41:513-514, June, 1945.

KOPETZKY, SAMUEL J.: Studies in Labyrinthine Fenestration to Improve Hearing (A Preliminary Report). THE LARYNGOSCOPE, 49:1064-1089, Nov., 1939.

KOPETZKY, SAMUEL J.: Discussion to Campbell. *Tr. Am. Ac. Opht. and Otolaryng.*, 44:278-299, 1939.

KOPETZKY, SAMUEL J.: History and Present Status of Operations on the Labyrinthine Capsule for Otosclerosis. *Surg., Gyn. and Obst.*, 72:466-489, Feb., 1941.

KOPETZKY, SAMUEL J.: Symposium: Progressive Deafness. Present Status of Medical and Surgical Therapy for the Deafened. THE LARYNGOSCOPE, 54:217-228, May, 1944.

KRANZ, FRED W.: A Report on the Fenestration Operation. Sonotone Corporation, Elmsford, N. J., 1946.

LAKE, RICHARD: Removal of the Semicircular Canals in a Case of Unilateral Vertigo. *Lancet*, 1:1567-1568, June 4, 1904.

LAKE, RICHARD: Aural Vertigo (Non-suppurative): A Clinical and Therapeutical Study. *Lancet*, 2:1638-1642, Dec. 14, 1912.

LATHROP, F. D.: Surgical Treatment of Otosclerosis. *Lahey Clinic Bull.*, 2:103-107, Apr., 1941.

LEDOUX, L.: Remarques techniques à propos de l'opération de Sourdille. *Bull. Soc. belge d' otol., rhinol. et laryng.*, 310-313, 1937.

LEGGETT, ELIZABETH A.: s. Shambaugh, Leggett and Wojniak.

LEMPERT, JULIUS: Improvement of Hearing in Cases of Otosclerosis:

A New, One-stage Surgical Technique. *Arch. Otolaryng.*, 29:42-97, July, 1938.

LEMPERT, JULIUS: Endaural Fenestration of External Semicircular Canal for Restoration of Hearing in Cases of Otosclerosis. Summary Report of One Hundred and Twenty Cases. *Arch. Otolaryng.*, 31:711-779, May, 1940.

LEMPERT, JULIUS: Discussion to Campbell. *Tr. Am. Ac. Opht. and Otolaryng.*, 44:301-303, 1939.

LEMPERT, JULIUS: Endaural Fenestration of the Horizontal Semicircular Canal for Otosclerosis. Indications, Technique, Observations as to Early and Late Results. THE LARYNGOSCOPE, 51:330-362, Apr., 1941.

LEMPERT, JULIUS: Fenestra Nov-Ovalis: New Oval Window for Improvement of Hearing in Cases of Otosclerosis. *Arch. Otolaryng.*, 34:880-912, Dec., 1941.

LEMPERT, JULIUS: Lempert Fenestra Nov-Ovalis with Mobile Stopple. *Arch. Otolaryng.*, 41:1-41, Jan., 1945.

LEMPERT, JULIUS: Technic of the Lempert Fenestration Operation. In: Chevalier Jackson and Chevalier L. Jackson: Diseases of the Nose, Throat and Ear. Philadelphia and London, W. B. Saunders and Co., 1945, pp. 380-388.

LEMPERT, JULIUS: Tympanosympathectomy. A Surgical Technique for the Relief of Tinnitus Aurium. *Arch. Otolaryng.*, 43:199-212, Mar., 1946.

LEMPERT, JULIUS; MELTZER, PHILIP E., and SPECTOR, BENJAMIN: Bone Repair Following Defects Made in the Skull of Cats by Means of Different Instruments. *Arch. Otolaryng.*, 36:473-490, Oct., 1942.

LEMPERT, JULIUS, and WOLFF, DOROTHY: Histopathology of the Incus and the Head of the Malleus in Cases of Stapedial Ankylosis. *Arch. Otolaryng.*, 42:339-367, Nov.-Dec., 1945.

LESHIN, NORMAN: s. Lewy and Leshin.

LEWY, ALFRED, and LESHIN, NORMAN: Summaries of Literature on Functional Examination of Hearing. *Arch. Otolaryng.*, 37:241-262, Feb., 1943.

DE LIMA, ERMIRO ESTEVAM: A otosclerose. Contribuicao ao seu tratamento cirurgico. Rio de Janeiro, Oficinas Alba Graficas, 1943.

DE LIMA, ERMIRO ESTEVAM: Estudo anátomo-cirurgico de uma nova via de acesso na operacao de otosclerose (via supra méatica). *Rev. med.-cir. do Brasil*, 51:101-108, Jan.-Mar., 1943.

DE LIMA, ERMIRO ESTEVAM: Tratamento cirurgico da otosclerose. *Rev. brasil de cirurg.*, 12:247-254, Mar., 1943. Also: *Bol. Col. brasil de cir.*, 18:151-158, July, 1943.

LINDSAY, J. R.: Histologic Observations on the Healing of Labyrinthine Fistulas in Monkeys. *Arch. Otolaryng.*, 43:37-48, Jan., 1946.

Local Surgical Measures. In: Otosclerosis. A Resumé of the Literature to July, 1928. Committee on Otosclerosis, American Otological Society, New York, Paul B. Hoeber, Inc., 1929, Vol. 2, pp. 559-584.

LOPEZ GARCIA, CAMILO: s. Rius and Garcia.

LOWY, KARL: Functional Studies on Labyrinthine Fenestration in Animals.—I. THE LARYNGOSCOPE, 55:6-19, Jan., 1945. Also: *Arch. Otolaryng.*, 41:376, May, 1945.

LOZA, G., y MAISONNAVE, R.: Otoesclerosis. Tratamiento quirurgico. *Rev. de oto-rino-laring. del Litoral*, 3:286-289, Oct.-Dec., 1944.

LURIE, MOSES H.: Deafness, Its Causes and What Can Be Done About It. *Arch. Otolaryng.*, 42:144-146, Aug., 1945.

LYMAN, H. W.: The Relief of Deafness in Otosclerosis by Fistulization of the Labyrinth. *Internat. Abstr. Surg.*, 217-224. In: *Surg., Gyn. and Obstr.*, 72: Mar., 1941.

MACDONALD, PHILIP G.: First Experimental Use of Cartilage to Maintain a Patent Fenestra in Bone. Preliminary Report of Animal Experiments to Secure Permanent Osseous Fenestra. *Arch. Otolaryng.*, 41:241-242, Mar., 1945.

MCGIBBON; cited by W. A. Mill: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:354-368, June, 1939.

MCLAURIN, J. V.: The Fenestration Operation for Otosclerosis: Its Possibilities and Its Limitations. *New Orleans M. and S. J.*, 99:209-215, Nov., 1946.

MAISONNAVE, R.: s. Loza and Maisonnave.

MARTIN, ROBERT C.: Fenestration Operation for Deafness. *California and Western Med.*, 62:311-312, June, 1945.

MATTE: Labyrinthtrepanation und Auskratzung des Vorhofs wegen qualvoller Geräusche bei sogenannter "Mittelohrsklerose-Oto-spongiose." *Deutsche med. Wochenschr.*, 32:841-844, May 24, 1906.

MAYBAUM, JACOB L.: Discussion to Goldman, J. L.: *Arch. Otolaryng.*, 41:227, Mar., 1945.

MAYBAUM, JACOB L.: Status of Fenestration Operation for Otosclerosis. *J. Mount Sinai Hosp.*, 13:1-5, May-June, 1946.

MELTZER, PHILIP E.: The Otosclerosis Operation. *Hearing News* (American Hearing Society), 14: pp. 1-2, 16, Dec., 1946.

MELTZER, PHILIP E.: s. Lempert, Meltzer and Spector.

MILL, W. A.: Operative Treatment of Ménière's Syndrome. St. Thomas' Hosp. Rep., 1:192-199, 1936.

MILL, W. A.: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:354-359, June, 1939.

MILLER, LOIS MATTOX: New Hope for the Deaf. *Hygeia*, 23:98-99, Feb., 1945.

MILLER, LOIS MATTOX: —And the Deaf Shall Hear. Condensed from *Hygeia. The Reader's Digest*, 46: No. 274, pp. 47-50, Feb., 1945.

MOLLISON, W. M.: The Operative Treatment of Vertigo. *Proc. Royal Soc. Med.*, 28:1597-1599, June, 1935. (Disc.: Sydney Scott, Peters.)

MOLLISON, W. M.: Surgical Treatment of Vertigo by Opening the External Semicircular Canal and Injecting Alcohol. *Acta otolaryng.*, 27:222, 1939.

MOULONGUET, A.: Une nouvelle technique chirurgicale pour le traitement de l'oto-spongiose, *Annales d' oto-laryng.*, (2):132-133, Feb., 1932.

NAGER, F. R.: Demonstration der Schnitte einer Patientin mit Otosklerose. *Acta otolaryng.*, 26:342, 1938.

NAGER, F. R.: Demonstration zur Holmgren' schen Otosklerose-operation an Affen. *Acta otolaryng.*, 27:350-358, 1939.

NASIELL, V.: Modern Treatment of Otosclerosis. *Arch. Otolaryng.*, 33: 916-925, June, 1941.

NEGUS, VICTOR: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:366, June, 1939.

NEVILLE, W. S. THACKER: Four Cases of Vertigo Treated by Operation. *Proc. Royal Soc. Med.*, 28:1599-1600, June, 1935. (Disc.: Sydney Scott, Peters.)

ORELL, S.: s. Engström and Orell.

Otosclerosis: A Resumé of the Literature from 1928-1935. *Annals Otol., Rhinol. and Laryng.*, 45:169-281, Mar., 1936. Surgical Treatment: pp. 265-269.

Otosclerosis: Index of the Literature on Otosclerosis from 1928-1935. *Annals Otol., Rhinol. and Laryng.*, 45:496-552, June, 1936. Treatment, Surgical, p. 501.

PANSE, RUDOLF: Die operative Behandlung hochgradiger Schwerhörigkeit. *Verh. deutscher otol. Ges.*, 6:141-145, June, 1897.

PASSE, E. R. G.: Surgical Treatment of 14 Cases of Otosclerosis. *J. Laryng. and Otol.*, 54:566-571, Sept., 1939.

PASSOW, KARL ADLOF: Operative Anlegung einer Offnung in die mediale Paukenhöhlenwand bei Stapesankylose. In: Disc. to Panse.

PEDERSEN, T. E.: The Fenestration Operation for Deafness: Psychological Factors. *Am. J. Nursing*, 45:726-727, Sept., 1945.

PERLMAN, H. B.: Radiation of the Ear. THE LARYNGOSCOPE, 54:255-266, June, 1944.

PETERS, E. A.: Drainage of Perilymph for Vertigo. *J. Laryng. and Otol.*, 44:460-465, July, 1929.

PETERS, E. A.: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:366-367, June, 1939.

PIENAAR, P., DE V.: Fenestration and Early Hearing Improvements: A Case Report. *South African M. J.* 20:405-407, July 27, 1946.

POHLMAN, A. G.: Acoustic Insulation of Cochlea and Its Relation to Fenestration Operation and Middle Ear Prosthesis. *Tr. Pacific Coast Oto-Opht. Soc.*, 27:27-39, 1942.

POPPER, O.: Fenestration of the Labyrinth. *J. Laryng. and Otol.*, 61: 24-37, Jan., 1946.

POPPER, O.: Fenestration pour l'otoscléose; la voie transtympanic. *Presse med.*, 54:648-649, Oct. 2, 1946.

POPPER, O.: Fenestration Operation for Otosclerosis: Transtympanic Approach. *South African M. J.*, 20:134-137, Mar., 1946.

PORTA, C. F.: Contribution to the Surgical Treatment of Otosclerosis. *Atti R. Accad. fisiocrit. Siena*, 8:215, 1940.

PORTMANN, GEORGE: Considérations sur la pathogénie de la surdité progressive. *Presse medicale*, 50:674, Nov. 7, 1942.

RIUS, MARIO: Resultados audiométricos del ler caso operado segundo la tecnica de la ventana neo-oval de Lempert. *An. oto-rino-laring. del Uruguay*, 12:217-220, 1942.

RIUS, MARIO: Nuevo apparato para microcirugia otologica. *An. oto-rino-laring. del Uruguay*, 12:225-230, 1942.

RIUS, MARIO: El examen vestibular pre y post-operatorio de la trepanación acustica perilinfatica. *An. oto-rino-laring. del Uruguay*, 13: 129-131, 1943.

RIUS, MARIO: El espacio perilinfatico otico. Montevideo, Uruguay, Editorial Mosca Hermanos, 1943.

RIUS, MARIO, y APOLO, E.: El injerto de marfil en la ventana de la operación neo-ovalis de Lempert. *An. oto-rino-laring. del Uruguay*, 13: 123-128, 1943.

RIUS, MARIO, y GARCIA LOPEZ, C.: Constitución del liquido perilinfatico del oido interno. *An oto-rino-laring. del Uruguay*, 12:126-128, 1942.

Royal Society of Medicine, London, Section on Otology: Discussion on

Modern Surgery of the Labyrinth, Feb. 3, 1939. *J. Laryng. and Otol.*, 54:354-370, June, 1939.

Science News Letter: Many Deaf Gain Hearing. *Science*, Dec. 28, p. 411, 1946.

SEGRE, RENATO: Conocimientos actuales sobre tratamiento de las sorderas progresivas. *Rev. brasil. oto-rino-laring.*, 10:647-663, Nov.-Dec., 1942.

SELLERS, L. M.: Endaural Surgery of the Mastoid, Including the Fenestration Operation. Dallas Southern Clinical Soc., Mar. 17-20, 1947.

SEICER, ANTE: Meine ersten Erfahrungen auf dem Gebiete der operativen Otosklerosetherapie. *Zeitschr. f. Hals-, Nasen- u. Ohrenheilk.*, 46: 331-344, Oct., 1939.

SHAMBAUGH, GEORGE E., JR.: Chronic Progressive Deafness Including Otosclerosis and Diseases of the Inner Ear. Progress in Otolaryngology. Summary of the Bibliographic Material Available in the Field of Otolaryngology. *Arch. Otolaryng.*, 26:582-605, Nov., 1937; 28:780-816, Nov., 1938; 30:999-1036, Dec., 1939.

SHAMBAUGH, GEORGE E., JR.: Operative Treatment of Otosclerosis: Reply to a Recent Criticism. *Arch. Otolaryng.*, 32:927-933, Nov., 1940.

SHAMBAUGH, GEORGE E., JR.: Chronic Progressive Deafness Including Otosclerosis and Diseases of the inner ear. Progress in Otolaryngology. Summary of the Bibliographic Material Available in the Field of Otolaryngology. *Arch. Otolaryng.*, 33:436-474, Mar., 1941.

SHAMBAUGH, GEORGE E., JR.: Factors Influencing Hearing Improvement After Fenestration for Otosclerosis. *Arch. Otolaryng.*, 33:901-902, May, 1941; *Ann. Otol., Rhinol. and Laryng.*, 50:618-620, June, 1941. (Disc.: Theobald, Greenwood.)

SHAMBAUGH, GEORGE E., JR.: Surgical Treatment of Otosclerosis. *Wisconsin M. J.*, 40:488-492, June, 1941.

SHAMBAUGH, GEORGE E., JR.: The Surgical Treatment of Deafness. *Illinois M. J.*, 81:104-108, Feb., 1942.

SHAMBAUGH, GEORGE E., JR.: Otosclerosis. Results with the Fenestration Operation After Three and One-half Years. *J. A. M. A.*, 119:243-248, May 6, 1942.

SHAMBAUGH, GEORGE E., JR.: A Modified Fenestration Technic. Analysis of Results in One Hundred and Forty-one Consecutive Operations. *Arch. Otolaryng.*, 36:23-46, July, 1942.

SHAMBAUGH, GEORGE E., JR.: Surgical Treatment of Otosclerosis: Comparative Analysis of Results Using Different Technics. *Annals Otol., Rhinol. and Laryng.*, 51:817-829, Sept., 1942.

SHAMBAUGH, GEORGE E., JR.: Deafness or Impaired Hearing. *J. Michigan Med. Soc.*, 42:525-529, July, 1943.

SHAMBAUGH, GEORGE E., JR.: Technic to Prevent Bony Closure on Monkeys. Scientific Exhibit, Am. Ac. Opht. and Otolaryng., Chicago, 1944.

SHAMBAUGH, GEORGE E., JR.: Comparison of Improvement in Hearing Following the Fenestration Operation with That Obtained by Wearing a Hearing Aid. *Arch. Otolaryng.*, 41:189-192, Mar., 1945.

SHAMBAUGH, GEORGE E., JR.: Fenestration Operation for Otosclerosis. *Am. J. Nursing*, 45:725, Sept., 1945.

SHAMBAUGH, GEORGE E., JR.: Fenestration Operation: Clinical Study of Permanence of Its Results. *Quart. Bull. Northwestern Univ. Med. School*, 19:259-264, 1945.

SHAMBAUGH, GEORGE E., JR.: The Fenestration Operation for Otosclerosis. *J. A. M. A.*, 130:999-1006, Apr. 13, 1946.

SHAMBAUGH, GEORGE E., JR.: Factors Influencing Osteogenesis Following the Fenestration Operation: Observations on the Monkey. *Annals Otol., Rhinol. and Laryng.*, 55:705-708, Sept., 1946. (Disc.: Perlman.)

SHAMBAUGH, GEORGE E., JR.: Preliminary Results with a New Fenestration Technic. *Illinois M. J.*, 90:264-265, Nov., 1946.

SHAMBAUGH, GEORGE E., JR.: Experimental Fenestration of the Labyrinth. Annual Report of the John and Mary R. Markle Foundation, 1946, p. 71.

SHAMBAUGH, GEORGE E., JR., and CUTLER, M. H.: Chronic Progressive Deafness, Including Otosclerosis and Diseases of the Inner Ear. Progress in Otolaryngology. Summary of the Bibliographic Material Available in the Field of Otolaryngology. *Arch. Otolaryng.*, 41:147-154, Feb., 1945.

SHAMBAUGH, GEORGE E., JR., and JUERS, ARTHUR L.: Surgical Treatment of Otosclerosis. *Arch. Otolaryng.*, 43:549-567, June, 1946.

SHAMBAUGH, GEORGE E., JR.; LEGGETT, ELIZABETH A., and WOJNIAK, FRANK J.: Chronic Progressive Deafness, Including Otosclerosis and Diseases of the Inner Ear. Progress in Otolaryngology. Summary of the Bibliographic Material Available in the Field of Otolaryngology. *Arch. Otolaryng.*, 39:434-457, May, 1944.

SHAMBAUGH, GEORGE E., JR., and WOJNIAK, FRANK: Chronic Progressive Deafness, Including Otosclerosis and Diseases of the Inner Ear. Progress in Otolaryngology. Summary of the Bibliographic Material Available in the Field of Otolaryngology. *Arch. Otolaryng.*, 37:856-881, June, 1943.

SILCOX, LOUIS E.: s. Campbell and Silcox.

SILVERMAN, S.: s. Walsh and Silverman.

SMITH, J. MORRISSET: The Fenestration Operation for Otosclerosis. Report of Thirty-two Cases. *Arch. Otolaryng.*, 37:174-182, Feb., 1943.

SMITH, J. MORRISSET: Report of Eighty-five Fenestration Operations for Otosclerosis. *New York State J. M.*, 44:1771-1777, Aug. 15, 1944.

SOURDILLE, MAURICE: Nouvelles techniques opératoires pour le traitment des surdités chroniques progressives ou otosclérose. *Arch. internat. laryng.*, 9:200-220, Feb., 1930. Also: *Acta otolaryng.*, 15:13-34, 1931.

SOURDILLE, MAURICE: Traitement chirurgical de l'otospongiose. *Soc. Malad. Oreille*, Apr., 1930.

SOURDILLE, MAURICE: The Surgical Treatment of Otosclerosis. *Proc. Royal Soc. Med.*, 23:1443-1455, Aug., 1930. (Disc.: Jenkins, McKenzie, Kisch, Dundas-Grant, Gibb.)

SOURDILLE, MAURICE: Résultats primitifs et secondaires de quatorze cas de surdité par otospongiose opérés. *Rev. laryng.*, 51:595-604, Oct., 1930.

SOURDILLE, MAURICE: Trépanation acoustique du labyrinthe en un temps. *Annales malad. de l'oreille, du larynx*, 49:1025-1029, Nov., 1930.

SOURDILLE, MAURICE: Soc. Francaise de laryng., 1931.

SOURDILLE, MAURICE: Congrés internat. de Otorhinolaryng., Madrid, 1932.

SOURDILLE, MAURICE: Sur le traitement chirurgical de l'otospongiose; principes généraux, resultats et mécanism; indications opératoires. *Rev. laryng.*, 53:281-309, Mar., 1932.

SOURDILLE, MAURICE: Le traitement de l'otospongiose et sa technique opératoire. *Rev. laryng., suppl.*, pp. 1-39, Sept.-Oct., 1932.

SOURDILLE, MAURICE: The Surgical Treatment of Otospongiosis and Its Operative Technique. *Rev. laryng. suppl.*, pp. 41-68, Sept.-Oct., 1932.

SOURDILLE, MAURICE: Traitement chirurgical de l'otospongiose. Paris, Chauteney, 1935.

SOURDILLE, MAURICE: Le traitement chirurgical de l'otospongiose. Rapport, Congr. Franc. d'Otorhinolaryng., 1935.

SOURDILLE, MAURICE: Traitement chirurgical de l'otospongiose. *Otorhino-laryng. internat.*, 19:798-802, Dec., 1935.

SOURDILLE, MAURICE: El traitamiento quirurgico de la otoespongiosis y su técnica operatoria. *Rev. oto-neuro-oftal.*, 12:262-276, Oct., 1937.

SOURDILLE, MAURICE: Sur le traitement chirurgical de l'otospongiose. *Zeitschr. Hals-, Nasen- u. Ohrenheilk.*, 40:514-517, 1937.

SOURDILLE, MAURICE: The Present Position of the Surgical Treatment of Otosclerosis. *Proc. Royal Soc. Med.*, 30:1519-1522, Oct., 1937; *J. Laryng. and Otol.*, 53:78-83, Jan., 1938.

SOURDILLE, MAURICE: A New Technique in the Surgical Treatment of Severe and Progressive Deafness from Otosclerosis. *Bull. New York Acad. Med.*, 13:673-691, Dec., 1937. Also: THE LARYNGOSCOPE, 47:853-873, Dec., 1937. (Disc.: Fowler, Jr., Kopetzky, Kernan, Fowler, Jr., Babcock.)

SOURDILLE, MAURICE: Présentation de l'un des cas opérés. *Annales malad. de l'oreille, du larynx*, 57:418, Apr., 1938.

SOURDILLE, MAURICE: Sur le traitement chirurgical de l'otospongiose. Principés généraux résultats et mécanism. Indications opératoires. *Rev. laryng.*, 53:281-309, Mar., 1942.

SPAKE, L. B.: The Surgical Treatment of Deafness. *J. Kansas M. Soc.*, 42:220-222, May, 1941.

SPECTOR, BENJAMIN: s. Lempert, Meltzer and Spector.

SULLIVAN, JOSEPH A.: Surgery of the Mastoid. *Arch. Otolaryng.*, 37: 845-851, June, 1943.

SULLIVAN, JOSEPH A.: Indications for, and End Results of, Fenestration Operation. *Canad. M. A. J.*, 53:543-548, Dec., 1945.

TATO, JUAN MANUEL: Opéración de Sourdille, ler tiempo. *Rev. Asoc. med. argentina*, 47:2781-2783, July, 1933.

TATO, JUAN MANUEL: Sobre dos casos de opéración de Sourdille. *Rev. med. argentina*, 49:470-473, Apr., 1935.

TATO, JUAN MANUEL: Le traitement chirurgical de l'otosclerose. Opéración de Sourdille. Mon expériences et résultats. C. r. Soc., Franc. d'Otorhinolaryng., 1937.

TATO, JUAN MANUEL: El tratamiento quirurgico de la otoesclerosis. *Rev. argentina de oto-rino-laring.*, 11:183-296, May, 1942. Also: Relato oficial, Soc. Rioplatense de Otorinolaring., p. 113, 1942. Also: *Rev. otorinolaring.*, 3:88-144, Sept., 1943.

TATO, JUAN MANUEL, y SEGRE, RENATO: El examen laberintico estático y dinámico en los otoesclerosos antes y después de la trépananación acustica laberintica. *Rev. argentina de otorinolaring.*, 11:515, Nov., 1942.

THOMPSON, EVA: s. Hughson and Thompson.

UFFENORTDE, W.: Eingriffe am inneren Ohr aus funktioneller Anzeige. In: Die chirurgischen Erkrankungen des inneren Ohres. In: Katz, L., and Blumenfeld, F.: Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege. 3rd ed., Leipzig, 1925, Curt Kabitzsch., pp. 852-856.

WALSH, THEO. E., and SILVERMAN, S. RICHARD: Diagnosis and Evaluation of Fenestration. THE LARYNGOSCOPE, 56:536-555, Sept., 1946.

WATKYN-THOMAS, F. W.: Discussion on Modern Surgery of the Labyrinth. *J. Laryng. and Otol.*, 54:362, June, 1939.

WEBBER, JULIUS A.: Fenestration Operation for Otosclerosis Deafness. *J. A. M. A.*, 131:1070, July 27, 1946.

WILLIAMS, HENRY L.: The Fenestration Operation for Restoration of Hearing to Conversational Levels in Loss of Hearing Due to Clinical Otosclerosis. *Proc. Staff Meet., Mayo Clin.*, 21:320-326, Aug. 21, 1946.

WILLIAMS, HENRY L.: The Fenestration Operation. *J. Rehabilitation*, 12:9-13, Dec., 1946.

WISHART, DAVID EDMUND STAUNTON: Guillotine for Removal of Head of Malleus in Lempert Operation. THE LARYNGOSCOPE, 49:307-308, Apr., 1939.

WOJNIAK, F.: s. Shambaugh and Wojniak.

WOLFSON, LOUIS E.: Surgical Methods: In: Fischer, Joseph, and Wolfson, Louis E.: The Inner Ear. New York, 1943, Grune and Stratton, pp. 188-194.

Year Book of the Eye, Ear, Nose and Throat. Chicago, The Year Book Publishers. Otosclerosis and Surgical Treatment, 1941, pp. 423-437. Surgical Treatment of Deafness, 1942, pp. 428-440.

YEARSLEY, M.: Operative Treatment of Labyrinthine Vertigo. *Lancet*, 2:618-619, Sept. 10, 1938.

ZONDERMAN, BERNARD: s. Leighton and Zonderman.

BOOK REVIEW.

The Rehabilitation of Speech (revised edition). By Robert West, Professor of Speech Pathology, University of Wisconsin; Lou Kennedy, Associate Professor of Speech, Louisiana State University; Anna Carr, Clinical Adviser in Speech, State Teachers College, Milwaukee; with a chapter by Ollie L. Backus, Assistant Professor of Speech, University of Michigan. Six hundred fifty pages including Index. New York and London: Harper and Brothers. 1947. Price $5.00.

The Rehabilitation of Speech has been rewritten, including results of research since the publication of the first edition in 1936. Book I, entitled the Pathology of Speech and the Rationale of Its Rehabilitation, was written by Dr. Robert West. In the introduction the distinction between a disorder and a defect is again made. Succeeding chapters discuss the neurophysiological mechanism of speech; education vs. re-education in comparing normal and abnormal development of speech; psychogenic disorders; stuttering (spasmophemia); dyslalias caused by mouth deformities; rhinolalias caused by nasal obstruction; dysphonias; neuropathologies of speech, which include spastic speech, choreatic speech and dysphasia; speech defects of the feebleminded; dyslalias caused by deficiencies of hearing; disorders of speech perception; and a final chapter entitled Case Study and Diagnosis, which includes a study outline for the diagnosis of disorders of speech.

The chapter on Speech Perception gives a simple definition of acoustic recruitment and outlines the advantages and disadvantages of lipreading. Many of the questions that arise concerning acoustic amplification are answered conclusively, although much research is still in progress on several of these problems.

Book II is entitled Remedial Principles and has been written by Dr. Kennedy, Miss Carr, with one chapter by Dr. Backus. This section is designed to serve as a practical guide for the clinician. Personal qualifications of the clinician and equipment of the speech clinic are listed. General exercises are discussed first and then exercises for special articulatory defects.

The chapter on Dyslalia includes causes, treatment and articulatory drills. Individuals with speech defects of psychogenic origin need speech training and social retraining. Stuttering is discussed in terms of remedial procedures for both child and adult. Successive chapters present remedial treatment for rhinolalia, speech defects associated with oral deformities of the lips, tongue, teeth and palate, and types of dysphonia. Cooperation of the child, intelligence and voluntary control of speech apparatus are all factors influencing the speech progress of the cerebral-palsied.

Rehabilitation of persons with aphasia has been written by Ollie L. Backus. The program stresses teaching the aphasic as a whole, promoting adjustment to the environment, and includes techniques of speech therapy and other language processes.

A chapter on remedial procedures for children gives exercises for those using sound substitutions and for those with other kinds of speech defects.

Spasmophemia (stuttering), adult aphasia, dysphemia; mutism with deficient hearing, speech dysarthria (spastic speech) and substitution and

omission of speech sounds with auditory impairment are illustrated by case histories to conclude this section.

The appendices give detailed information on techniques for the examination of physical organs of speech and for the determination of optimum pitch. Tests of hearing and detailed tests of articulation are also presented. Height and weight tables and instructions for calculating the index of dental maturation are included. A glossary of terms used in the text concludes the volume.

This book in its revised edition will serve the same need as the original edition; namely, that of a good text for students of speech pathology and as an excellent source of guidance for the clinician. H. S. L.

INTERNATIONAL SURGICAL ASSEMBLY.

The Sixth International Assembly of the International College of Surgeons will be held in Rome, Italy, at the invitation of the Italian Government, during the week of May 16-23, 1948, under the presidency of Prof. Raffaele Bastianelli and Prof. Raffaele Paolucci, of Rome, and Prof. Mario Dogliotti, of Turin. The secretary of the Assembly is Prof. Giuseppe Bendandi, of Rome. Attendance is not limited to the membership of the College; all surgeons in good standing in their medical organizations are invited. Scientific meetings, scientific and commercial exhibits, visits to the Universities of Turin and Milan have been arranged, together with tours to other medical centers in Europe. A special exhibit of ancient texts on surgery is being arranged by Prof. Davide Giordano, of Venice, honorary president, under the active presidency of Prof. Adalberto Pazzini, professor of history at the University of Rome. This extraordinary exhibit dealing with ancient surgery will be on display in the Vallicelliana Library in one of the historical buildings of the Vatican. Detailed information may be obtained from Dr. Max Thorek, General Secretary, 850 Irving Park Road, Chicago 13. For travel information, address the All Nations Travel Bureau, 38 South Dearborn Street, Chicago, the official travel representatives for this Assembly. Those desiring to present scientific papers, address Dr. Karl Meyer, Cook County Hospital, Chicago; Dr. Henry W. Meyerding, Mayo Foundation, Rochester, Minn., or Dr. Herbert Acuff, Acuff Clinic, 514 West Church Street, Knoxville, Tenn. Those from Canada should direct their inquiries to Dr. Lyon Appleby, 925 W. Georgia Street, Vancouver, B. C.

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Meeting: New York, N. Y., Jan. 16, 1948.
Middle—Chairman: Dr. Hugh G. Beatty, Columbus, Ohio.
Meeting: Columbus, Ohio, Jan. 19, 1948.
Southern—Chairman: Dr. William A. Wagner, New Orleans, La.
Meeting: New Orleans, La., Jan. 23, 1948.
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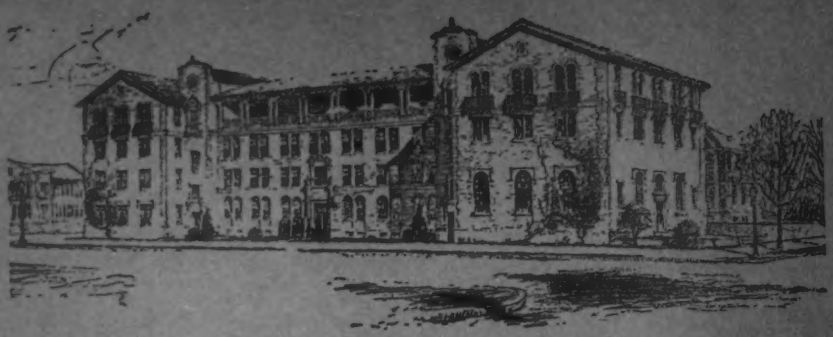

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